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SINGLE STAGE EXPERIMENTAL EVALUATION OF HIGH MACH NUMBER COMPRESSOR ROTOR BLADING PART 5 - PERFORMANCE OF ROTOR 2B

by

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prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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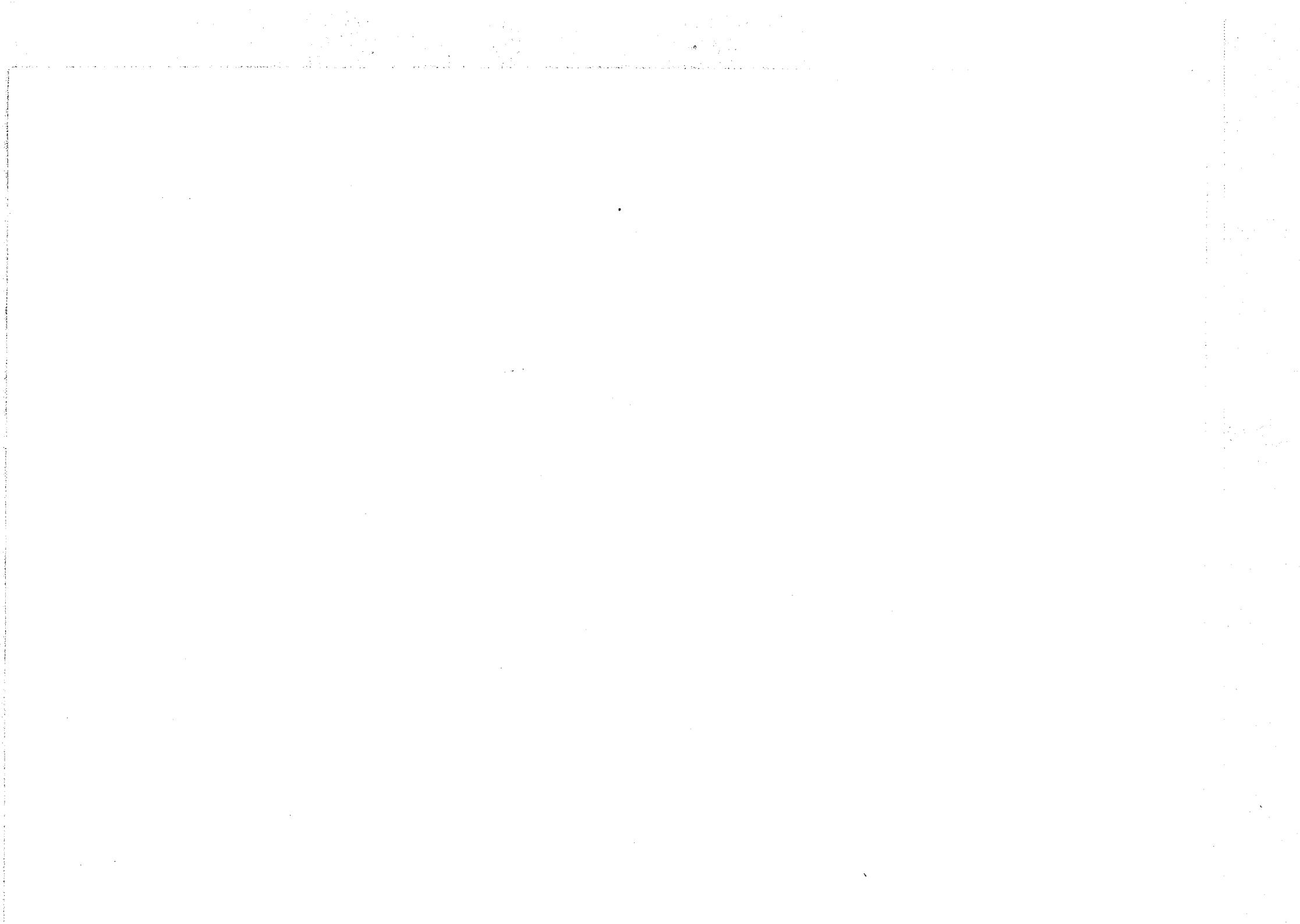
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ABSTRACT

A 1400 foot per second tip speed rotor with a 0.5 hub-tip radius ratio, designed to deliver a total pressure ratio of 1.76 and a rotor adiabatic efficiency of 0.837 at a flow of 215.49 lbs/sec, was tested with and without inlet flow distortion. For a point at design speed, judged to have adequate stall margin for engine operation, a total-pressure ratio of 1.763 and an adiabatic efficiency of 0.876 were achieved at a flow of 223.5 lbs/sec. The peak adiabatic efficiency of 0.885 at design speed occurred close to the stall line.

SUMMARY

A 1400 foot per second tip speed rotor, designed to have a diffusion factor of 0.45 at the tip, was tested both with an undistorted inlet flow and with radial and circumferential distortions. A new type of blade shape has been employed in which the camber line consists of two circular arcs that are mutually tangent at the point where they join. The tip element was designed to have the minimum amount of camber in the supersonic portion of the blade which was consistent with flow choking limitations; this type of tip shape was smoothly blended into a double-circular-arc shape at approximately the 60% span location. The hub-tip radius ratio at inlet is 0.50. Neither inlet guide vanes nor a stator vane row were employed.

The rotor was designed to deliver a total-pressure ratio of 1.76 and a rotor adiabatic efficiency of 0.837 at a flow of 215.49 lbs/sec. For conditions on the 100% speed line, judged to have adequate stall margin for engine operation, a total-pressure ratio of 1.763 and an adiabatic efficiency of 0.876 were achieved at a flow of 223.5 lbs/sec. The peak adiabatic efficiency of 0.885 at design speed occurred close to the stall line.

During testing with an undistorted inlet flow, blade element data were obtained over a range of speeds from 50% to 110% design speed. Results of these blade element measurements were used to show the variation of deviation angle, diffusion factor and loss coefficient as a function of incidence angle. Rotating stall was observed at these speeds and overall performance data were obtained while in stall.

The rotor was tested at three speeds with radial and with circumferential flow distortion screens installed. The points on the performance map at which the rotor stalled were also determined during distortion running. The screens produced a 20% distortion of total pressure at 100% speed and had a substantial effect on rotor performance.

INTRODUCTION

Sufficient data and a reasonable model for the design of front stage rotors having tip speeds of 1400 feet per second and higher have not been published at this time, although isolated demonstrations of efficient performance have been given. The purpose of the current experimental program is to determine the performance potential of such rotors and to obtain blade element data that will assist in the selection of an optimum blade shape.

It has previously been considered that blade elements with relative Mach numbers in excess of 1.2 have the potential for high losses, due to shocks, when simple blade shapes such as the double-circular-arc are used. For the design of the rotors which will be evaluated in this program a new type of blade shape has been employed in which the camber line consists of two circular arcs that are mutually tangent at their junction point. This point is directly across the flow passage from the leading edge of the adjacent blade that forms the other side of the flow passage. The front arc is identified as the supersonic arc, and the rear arc is identified as the subsonic arc. The term, camber ratio, refers to the ratio of the camber of the supersonic arc to the total camber. Blade elements developed in this way are called multiple-circular-arc elements.

In references 1, 2 and 3 the performance of three medium-aspect-ratio rotors, designed for a tip speed of 1400 feet per second, has been given. Rotor 1B, the first of the series, was designed for a tip diffusion factor of 0.35. Two other blade rows were designed for a tip diffusion factor of 0.45 and tip camber ratios of 0.35 and 0.65 - the latter being the value corresponding to a double-circular-arc blade. Rotor 2B is the fourth rotor in the series. It also has a tip diffusion factor of 0.45 and the tip element has the minimum amount of camber in the supersonic portion of the blade which is consistent with choke-free operation; this effectively gives a camber ratio of zero. All rotors have double-circular-arc elements from the hub outboard to approximately the 60% span location.

Details of the design of Rotor 2B and the other rotors evaluated in this test series are given in reference 4. This report presents results of tests on Rotor 2B, with uniform inlet flow and with radial and circumferential distortion of the inlet flow.

SYMBOLS

The following symbols are used in this report:

A flow area, in²

A_j area represented by each discharge rake element. This is the area of an annulus bounded either by radii midway between those of two adjacent elements or by the hub or casing, in²

a distance along chord line to position where maximum perpendicular displacement between camber line and chord line occurs, in

C_h enthalpy-equivalent static-pressure-rise coefficient,

$$C_h = \frac{2gJc_p t_1 \left[\left(\frac{P_2}{P_1} \right)^{\frac{\gamma-1}{\gamma}} - 1 \right] - (U_2^2 - U_1^2)}{V_1'^2}$$

C_p static-pressure-rise coefficient,

$$C_p = \frac{P_2 - P_1}{P_1' - P_1}$$

c blade chord length, in

c_p specific heat at constant pressure, Btu/lb-°R

D diffusion factor,

$$D = 1 - \frac{V_2'}{V_1'} + \frac{r_2 V_{\theta 2} - r_1 V_{\theta 1}}{2 \bar{r} \sigma V_1'}$$

g acceleration due to gravity, 32.174 ft/sec²

i incidence angle, difference between air angle and camber line angle at leading edge in cascade projection, deg

\vec{i}_k unit vector in direction of intersection of axisymmetric stream surface and blade mean surface

J mechanical equivalent of heat, 778.161 ft-lb/Btu

M Mach number

P total or stagnation pressure, psia

P_{in}	compressor inlet average total pressure, psia
P_j	arithmetic average total pressure at j immersion, psia
P_{max}	average total pressure in undistorted region, psia
P_{min}	average total pressure in distorted region, psia
p	static or stream pressure, psia
r	radius, in
\bar{r}	mean radius, average of streamline leading-edge and trailing-edge radii, in
T	total or stagnation temperature, °R
T_j	arithmetic average total temperature at j immersion, °R
t	static or stream temperature, °R
t	blade thickness, in
t_e	blade edge thickness, in
t_m	blade maximum thickness, in
U	rotor speed, ft/sec
V	air velocity, ft/sec
V_{zj}	average axial velocity at j immersion, ft/sec
w	weight flow, lb/sec
Z	displacement along compressor axis, in
β	air angle, angle whose tangent is the ratio of tangential to axial velocity, deg
γ	ratio of specific heats
γ°	blade-chord angle, angle in cascade projection between blade chord and axial direction, deg
δ	ratio:- <u>total pressure</u> , <u>psia</u> <u>standard pressure</u> 14.696 psia

δ°	deviation angle, difference between air angle and camber line angle at trailing edge in cascade projection, deg
ε°	meridional angle, angle between tangent to streamline projected on meridional plane and axial direction, deg
θ	ratio: - $\frac{\text{total temperature}}{\text{standard temperature}}$, ${}^{\circ}\text{R}$ $518.688{}^{\circ}\text{R}$
θ°	angular displacement about compressor axis, deg
η	efficiency
κ°	angle between cylindrical projection of \vec{i}_K and axial direction, deg
ρ	static or stream density, $\text{lb}\cdot\text{sec}^2/\text{ft}^4$
ϕ°	camber angle, difference between angles, in cascade projection, of tangents to camber line at extremes of camber line arc, deg
σ	solidity, ratio of chord to spacing
ψ	stream function; $\psi_h = 0$, $\psi_c = 1$
\bar{w}	total-pressure-loss coefficient

Subscripts:

a	point on camber line where maximum camber line rise occurs
ad	adiabatic
an	annulus value
avg	arithmetic average at any plane
c	tip or casing at any plane
d	downstream
e	equivalent two-dimensional cascade
h	hub at any plane
j	immersion number
m	meridional direction

p polytropic
s suction surface
t tip at rotor leading edge plane
t total when referring to blade element
u upstream
z with respect to axial displacement
 θ with respect to meridional displacement
1 leading edge
2 trailing edge
0.05, 0.86, 0.95, 1.51, 1.57, 2.0 instrumentation plane designations
(fig. 5)

Superscripts:

* critical flow condition
' relative to rotor

APPARATUS AND PROCEDURE

Test Rotor

The design of the rotor used in this test investigation is presented in reference 4 in which it is identified as Rotor 2B. The rotor was designed for a corrected weight flow per unit frontal area of 29.66 lbs/sec per square foot. With the selected rotor tip diameter of 36.5 inches and the hub-tip radius ratio of 0.50, the design corrected weight flow is 215.49 lbs/sec. The selection of a rotor tip solidity of 1.3, a diffusion factor of 0.45, zero inlet swirl, a rotor tip speed of 1400 ft/sec, and an axial velocity ratio of 0.91 permitted the calculation of the change in angular momentum across the rotor at the rotor tip. This change in angular momentum, with a suitable rotor total-pressure-loss coefficient derived from the NASA method of references 5 and 6, resulted in a design rotor total-pressure ratio of 1.76. The design total-pressure ratio was held constant radially. Because the loss correlation resulted in radially varying losses, a radial variation of the change in angular momentum was used in the design vector diagram calculations.

Double-circular-arc blade sections were used in the cascade projection* along the radial height of the blade between the hub and a point approximately 60 per cent of the span away from the hub. Multiple-circular-arc sections were used in the remaining portion of the blade. The tip blade element for Rotor 2B was selected to have the minimum amount of camber in the supersonic or uncovered portion of the blade which was consistent with flow choking limitations.

Tabulations of the blade design data appear in Table 1. The overall view of the assembled Rotor 2B in figure 1(a) shows the blade trailing edges and a close-up view of the tip section is shown in figure 1(b).

In order to assess the quality of the blading after manufacture, the blading was inspected by means of contour layouts from six of the twelve manufacturing sections for six blades selected at random from the batch. A meridional view of the rotor appears in figure 2 and the inspected sections are identified by asterisks. At each manufacturing section the average of the six blades was obtained and was compared with the design intent. The results of the comparisons of the average blade sections with design intent appear in figures 3(a) through 3(f). The discrepancy at section KK is such that the tip element of the blade is about 0.4° more closed than design intent. Since no similar discrepancies were present at other blade sections, and since no significant errors were detected in the part span shrouds, it is judged that the blading was adequate to achieve design intent.

The average running tip clearance at 100% speed was 0.038 inches.

Test Facility and Instrumentation

Performance tests of this rotor were made in General Electric's House Compressor Test Facility, at Lynn, Massachusetts. A diagram of the test set up is given in figure 4 and the facility is described in reference 1. As was the case for all earlier tests, a flow straightener was installed in the vehicle inlet. The flow straightener, which was removed for some of the later tests on this rotor, is indicated in figure 4. The length of the flow straightener was 8" and the honeycomb-type cells had an equivalent diameter of approximately 7/8".

Instrumentation was identical with that used for the testing of Rotor 1B, with the exception of the rotor exit total temperature and total pressure rakes. For these rakes the sensors were at the five radial positions corresponding to the 10%, 30%, 50%, 70%, and 90% immersions. The meridional and circumferential locations of instrumentation are shown in figures 5 and 6

*As described in reference 4, the cascade projection is obtained by viewing the intersection of a blade and an axisymmetric stream surface in the radial direction. The justification for the use of this projection is given in reference 7.

respectively. The general construction features of the fixed rakes and traverse probes are illustrated in figures 7 and 8.

General Test Procedure

The following is an outline of the test sequence which was used during the testing of this rotor. With the throttle valve set to deliver approximately the design total-pressure-ratio at 100% corrected speed, data were recorded from fixed instrumentation at 50%, 70%, 90%, 100% and 110% corrected speeds. (When only fixed instrumentation measurements are taken, the data readings are termed green readings). The test rotor was returned to 50% corrected speed and the throttle valve closed until the limit of stall-free operation was achieved. With the throttle re-set so that the vehicle operated as close to stall as feasible, blade element data and a green reading were obtained. This procedure was repeated for the four remaining speeds. Blade element and green readings were then taken, at 90%, 100% and 110% speeds, over the remaining portion of the stall-free operating range up to the maximum facility flow capacity.

In order to obtain accurate measured performance at the 50% and 70% corrected speeds, data on these two speed lines were recorded with the instrumentation connected to provide measurements of pressure rise across the rotor rather than absolute pressures. The readings, for which the results are measured on this basis, are identified in table 2.

The instrumentation was again arranged to record absolute pressures. Green readings and hot-wire data were obtained in the stall region with the throttle valve closed to the setting where stall-free operation terminated. Instead of the usual procedure of suddenly dumping the flow to clear the rotor of stall, the throttle valve was opened gradually in order to investigate the hysteresis loop.

Green readings were obtained and the stall point was determined with radial and circumferential distortion screens installed. Corrected speeds of 70%, 90% and 110% were used in order to give better definition of performance than the 50%, 70% and 100% speeds which were used in testing Rotor 1B.

Upon completion of the part of the testing which had been originally planned a run was made with the inlet flow straightener removed. This run indicated a drop in performance of sufficient magnitude to make further testing necessary. In order to resolve this difference between readings taken with and without the flow straightener, a final run was made on Rotor 2B in which data were taken on the same day both with and without the flow straightener in place. This later testing was confined to the higher corrected speeds; green readings were taken and the point of stall inception was noted.

Testing in the Stall Free Region

During the initial testing the throttle positions at which readings were

taken in the stall free region of operation were selected to facilitate definition of each speed line. At low speeds this led to a relatively even spacing whereas at higher speeds the throttle positions were concentrated in the higher pressure ratio region where incidence variations occur. In the later testing, both with and without the flow straightener, the throttle positions which had been used in the original run were duplicated.

At the rotor inlet traverse location, the static pressure wedge was set to zero flow direction and the cobra probe was allowed to seek its nulled position. At the rotor exit traverse location the static pressure wedge was manually rotated to the angle orientation established by the nulled position of the cobra probe; since stationary vane rows and struts were relatively far removed from this plane, circumferential variations of angle were presumed to be sufficiently small not to affect the pressure read by the wedge static probe. Probe immersion indicators and the probe aerodynamic parameters were connected to conventional X-Y plotting equipment. In general, continuous traverses were only recorded for the rotor exit flow angle; these were used to give an indication of the radial extent of the part-span shroud wake. Recording of data from the traversing probes at the standard immersions was achieved by means of a digitized read-out on punched paper tape, as was also the case for the recording of data from fixed instrumentation.

Stall Testing Without Inlet Distortion

Rotating stalls were encountered, on closing the throttle valve, at all speeds. The rotor was stalled twice at each speed, the limit of stall free operation being established by closing the throttle valve slowly until performance and stress changes were noted. For the first stall at each speed the three traverse hot-wire anemometer probes were immersed at three different immersions. In this way a knowledge of the radial extent of the rotating stall cells was gained. For the second stall the hot wire anemometer probes were all set at the 10% immersion so that information was obtained from which the speed and number of rotating stall cells could be deduced.

Inlet Distortion Testing

The distortion screens were installed at the axial location shown in Figure 5. The radial distortion screen covered the outer 40% of the annulus area and the circumferential distortion screen covered the arc between 135° and 225°, as indicated in figure 6. Both screens had a 0.016" wire diameter on a 20 mesh. The distortion screens were supported by a coarse screen consisting of wires of 0.092" diameter, spaced three quarters of an inch apart. The radial distortion screen and its support are shown in figure 9(a) and the circumferential screen and its support are shown in figure 9(b).

The total pressure at the rotor inlet was measured with four distortion rakes at plane 0.86. Blade element data were not obtained during the distortion tests, and hot wire data were limited to that amount necessary to obtain a qualitative indication of the stall type. The point of stall

initiation was accurately determined, however.

Testing Without the Flow Straightener

Upon completion of the originally scheduled testing the opportunity arose for establishing the effect of the flow straightener on rotor performance. The flow straightener was removed and green readings were taken at the 90%, 100% and 110% corrected speeds. The throttle valve settings were such as to duplicate readings taken during the initial run; the rotor was also stalled once at each of these three speeds.

This test resulted in levels of flow and efficiency below those recorded in the initial run. Since it did not seem to be plausible to attribute the performance drop to the effect of the flow straightener alone, a final test was planned.

Final Testing

In order to resolve the difference between readings taken with and without the flow straightener, a final run was made on Rotor 2B in which data were taken both with and without the flow straightener in place. Firstly, with the flow straightener still removed, green readings were taken at design speed for the throttle valve settings previously established. The flow straightener was then replaced and green readings were obtained along the 90%, 100% and 110% corrected speed lines. Once more the rotor was stalled at these speeds.

RESULTS AND DISCUSSION

Sufficient data were recorded during the testing of this rotor to define the overall and blade element performance over the range of stall-free operation. A rotor performance map is presented in figure 10. An indication of the behavior of the rotor in stall was also obtained. In addition, as for the first rotor of the series, this rotor was run with radial and with circumferential inlet flow distortions. Because certain problems were present, necessitating more than one test run, a brief history of the performance is given in the next paragraph.

Performance History

A complete listing of the overall performance data (green readings) appears in table 2. The first run which was made on Rotor 2B followed the usual testing procedure, as described on the preceding pages. As a result of this run a high level of performance, corresponding to a design speed peak efficiency of 0.888, was measured. Data corresponding to this original run are given in table 2(a); sufficient fixed instrumentation data were obtained under these conditions to define a complete performance map.

Data were then taken with the inlet flow straightener (fig. 4), which had

always been used in previous testing, removed. Figure 11, which gives the performance at design speed for all the Rotor 2B tests, shows that a somewhat different performance was indicated. This run gave a rotor adiabatic efficiency which was about a point lower than that recorded during the first run and a nozzle weight flow about three quarters of a percent lower, for conditions giving adequate stall margin at design speed.

A detailed examination of the blading and test results after this second run revealed the following information that could possibly have a bearing on this discrepancy:

1. During stall testing at the end of the first run, the head from the upstream static wedge probe had come off and had dented the leading edges of three rotor blades. The dented blades were not replaced for the second run since the damage appeared minor.
2. Visual inspection of the blades after the second run revealed small deposits of dirt on the leading edges. These deposits were not as severe as those that had affected the performance of Rotor 1B (ref. 1), however.
3. The pitot-static rakes at plane 0.5 (fig. 6) that were used for inlet total-pressure measurements were close enough to the flow straightener outlet (14 inches) so that small variations of inlet total pressure (± 0.03 psia at design speed), associated with the wakes from the cells in the flow straightener, were recorded during the first run. These variations were not present when the flow straightener was removed. No distinct pattern of pressure variation over the cross section could be observed, nor should one be expected since the straightener cells were spaced randomly with respect to the pitot-static rake prongs.

In order to resolve this difference between readings taken with and without the flow straightener a final run was made on Rotor 2B in which data were taken, both with and without the flow straightener in place, on the same day. The blades were thoroughly cleaned before this run, but the dented blades were not replaced because the minor nature of the damage did not justify the expense of dis-assembly and re-assembly. The performance for this run was almost the same, both with and without the flow straightener, as evidenced by the results presented in tables 2(c) and 2(d) and also figure 11. This suggests that the previously noted discrepancy was not a result of the removal of the flow straightener, but was rather associated with testing conditions in some way. The performance level achieved during the final test with the flow straightener in place was generally consistent with data obtained in previous runs without the flow straightener. On this basis an efficiency penalty of, at the most, a quarter of a point is associated with the removal of the flow straightener. No significant drop in flow appears to be attributable to the removal of the flow straightener.

It therefore appears that the early testing on Rotor 2B, with the flow straightener in place, gave erroneous performance. In the absence of any other unusual features, the suspected culprit is the heavy rainfall which was prevalent for most of the early test. Adverse weather conditions of this magnitude were neither present for any of the testing on previous rotors nor for later testing on this rotor. Efficiency is computed based on the assumption that the air is dry. For given pressure and temperature measurements, tests on this rotor under conditions of one-hundred percent relative humidity would indicate about half a point higher efficiency than tests with zero relative humidity, because of the effects of humidity on gas properties. This may explain some of the efficiency discrepancy. It is also conceivable that water droplets could have been ingested; the effects of these on the recorded performance are unknown.

With the acceptance of this explanation it was decided to use data from the final run wherever possible. Accordingly, at the three highest speeds, the performance map (figure 10) and the quoted performance were obtained from fixed instrumentation data taken during the final run. With the exception of a few readings, blade element traverses were not made during this final run. All blade element traverse data used in this report are therefore taken from the original run.

No data whatsoever were taken at 50% and 70% corrected speeds during the final run. Accordingly, all data presented at the lower speeds were obtained during the original run.

Overall Performance

The compressor map for operation of the test rotor with uniform inlet flow (that is without inlet distortion screens) is shown in figure 10. Only one typical reading, for each throttle valve setting, has been plotted on the map.

The inlet total-temperature level was established as the arithmetic average of 24 inlet temperatures measured in the low velocity region at the facility inlet screen (figure 4). The rotor exit total-temperature and total-pressure ratio were established on the basis of fixed probe readings by a mass weighting routine, as follows. At each immersion, measurements from all circumferential locations were arithmetically averaged. The static pressure was assumed to vary linearly from hub to casing and was based on the measured average hub and casing values. With static pressure, total pressure, and total temperature known, static density and absolute velocity were computed at each immersion. The tangential velocity was obtained from the total-temperature rise and the Euler turbomachinery equation, and this, together with the absolute velocity and the design meridional streamline angle, gave the axial velocity. The discharge total-temperature and total-pressure ratio were then obtained from the following equations:

$$T = \frac{\sum_{j=1}^5 T_j \rho_j V_{zj} A_j}{\sum_{j=1}^5 \rho_j V_{zj} A_j}, \quad (1)$$

$$\frac{P}{P_{in}} = \left\{ \frac{\sum_{j=1}^5 \left[\left(\frac{P_j}{P_{in}} \right)^{\frac{\gamma-1}{\gamma}} - 1 \right] \rho_j V_{zj} A_j}{\sum_{j=1}^5 \rho_j V_{zj} A_j} + 1 \right\}^{\frac{\gamma}{\gamma-1}}. \quad (2)$$

These quantities were used with the real gas properties of dry air to compute the rotor adiabatic and polytropic efficiencies.

All points plotted on the map at the 50% and 70% corrected speeds were obtained, as described previously from direct measurements of pressure difference across the rotor. At these lower speeds, and especially with the throttle valve closed so that a large portion of the facility exit flow passed through the center pipe (figure 4), the measurements of flow obtained from the venturi flow nozzles proved to be unreliable. This occurred because the venturi pressure drop was so small for such cases (especially for the two nozzles in the stream that was throttled) that pressures were below the range of high accuracy for the measuring transducer. The bell mouth flow measurement was also found to be unreliable, primarily because of the small difference between the static and total pressures in the pitot-static rakes. The integrated flow from the rotor inlet traverse probe gave the only reasonable indication of the flow at the 50% and 70% corrected speeds. An accurate flow was obtained by plotting nozzle flows against integrated flows, drawing the best line through the points, and reading off the nozzle flow equivalent to the given integrated flow.

For the 90%, 100% and 110% corrected speeds the overall performance shown on the map was obtained exclusively from data recorded by the fixed instrumentation during the final run, with the flow straightener in place.

The maximum rotor adiabatic efficiency for Rotor 2B, of 0.952, was achieved at 50% corrected speed. At design speed the peak efficiency, of 0.885, occurred quite close to stall. For conditions at design speed, judged to have adequate stall margin, a total pressure ratio of 1.763 and an adiabatic efficiency of 0.876 were achieved at a flow of 223.5 lbs/sec. Rotor 2B was designed to deliver a total pressure ratio of 1.76 and a rotor adiabatic efficiency of 0.837 at a flow of 215.49 lbs/sec.

Stall Performance

The throttle position representing the limit of stall-free operation of the rotor, on closing the throttle, was recorded during all runs. The throttle valve setting at stall at each speed, was identical (to within the accuracy of measurement) for all runs, with or without the flow straightener. With this information and performance data at throttle positions close to the stall throttle position it is possible to extrapolate each speed line on the compressor map to the limit of stall free operation. The stall line determined in this manner is shown in figure 10. The overall performance measurements, recorded while the rotor was operating with stall present, appear as solid symbols in figure 10. Since the flow was quite unsteady for these readings, their accuracy is open to question.

Samples of the hot-wire anemometer data appear in figure 12. These are copies of Visicorder traces from the three anemometers. In figure 12(a) the anemometers are at immersions of 10%, 50% and 70%. A study of such traces gives an indication of the radial extent of the stall cells. In figure 12(b) the anemometers are each at 10% immersion. Unfortunately it is only possible to present two traces in this instance because one of the hot wires was damaged.

In order to establish the number and speed of the rotating stall cells, the phase difference between any two hot wires gives certain options and the use of a third anemometer eliminates all integral numbers except one. A knowledge of the paper speed of the trace and the number of cells permits deduction of the stall speed/rotor speed ratio. This method generally follows the method given in reference 8. Because of the previously noted difficulty with one of the hot wires only two traces were present and the use of this method did not give a unique solution. However, using the traces obtained with hot wires at the 10%, 50% and 70% immersions and assuming the center of each stall cell to be located along a radial line, valid results were obtained for number and speed of rotating stall cells. The radial stall cell assumption was validated by investigation of traces from the other rotors in which all hot wires were operable.

Another method for checking the number and speed of the rotating stall cells utilizes the traces from a rotor strain gauge and a hot wire. The number of stall cells can be calculated by adding the number of pulses per unit time of the strain gauge and the hot wire and dividing the total by the number of rotor revolutions for the same unit of time. The ratio of stall speed to rotor speed is calculated by dividing the number of pulses per unit time on the hot-wire trace by the product of the rotor revolutions per unit time and the number of stall cells.

The number and speed of the rotating stall cells determined by both methods were in good agreement. These data and other stalling performance information are presented in figure 12(c). At 110% corrected speed the traces did not conclusively reveal the radial extent of the stall cells. Although it

was possible to determine the number and speed of the stall cells, their radial extent has been labeled as "uncertain" in the appropriate column.

Blade Element Performance

For presentation of the data from traverse probes located upstream and downstream of the rotor, a method of adjusting the data to obtain conditions at the blade edges was used. Knowing the measured total pressure, total temperature, static pressure and flow angle at each immersion and using the design meridional streamline angle, the meridional Mach number and all velocity components at each measurement plane may be calculated. Application of the condition of constant angular momentum along design streamlines yields the tangential velocity at each blade edge. It is assumed that the shape of each meridional stream tube, between a measurement plane and its adjacent blade edge, remains fixed at the design shape for all data conditions. The meridional Mach number at a measurement plane may then be used to determine the meridional Mach number at the blade edge by use of the relationship shown in figure 13. This method is not strictly correct at the trailing edge where there may be an appreciable swirl velocity together with a change in radius between the edge and the measurement plane. Nevertheless, since the radius changes are not large, the method should be a very good approximation. With the tangential velocities and the meridional Mach numbers at the edges thus obtained, and with measured stagnation conditions assumed to be constant along the design streamlines, the velocities, Mach numbers, and all of their components may be determined at the blade edges. The constant physical quantities used in these computations at the measurement planes and at the edges are given in table 3.

In order to check out this procedure and to determine small differences due to calculation technique, design values of total pressure, total temperature, static pressure and flow angle were used in a sample calculation. Treating this information as though it were test data, the calculation routine was used to give design point blade element performance, yielding the data listed in table 4. Table 5 is included to give a more complete description of the abbreviations used. Some indication of the small differences which can occur is given in table 4 by the comparison of the integrated flows at the upstream and downstream measurement planes (labeled "L.E. and T.E. check weight flow"), with the nozzle flow. In this case the nozzle flow was set equal to the design flow.

Complete listings of blade element data are given in table 6 and graphs of some blade element data, plotted as a function of incidence angle, are presented in figure 14. In addition to the reduction of the traverse probe data, the performance for each element was also processed separately using fixed instrumentation stagnation temperatures and pressures in conjunction with the inlet relative Mach number obtained from the traverse probe data. The results of this computation, which are judged to be more reliable than results from the cobra traverse probes, are given as an addition in table 6.

The deviation angle and diffusion factor blade element traverse data presented in figure 14 were all recorded during the first run, before the flow straightener was removed and the performance measurement problem was encountered. The loss coefficients, in figure 14, at the 50% and 70% corrected speeds, were obtained during the first run, at the same time as the green reading fixed instrumentation data which were plotted on the performance map (fig. 10) and which were used to give the additional data presented in table 6. However, at the higher speeds, the loss coefficient data presented in figure 14 and as additional data in table 6 were those obtained from fixed instrumentation readings taken during the final run.

For most of the readings the part-span shroud wake impinged upon the center element. The position of the wake was similar to that obtained in the testing of Rotor 2E, as illustrated in figure 13 of reference 2. In the testing of Rotor 2B no consistent radial movement of the wake, upon closing the throttle valve, was observed.

Radial variations of total pressure, total temperature, flow angle and adiabatic efficiency are presented in figure 15. These were obtained from a continuous cobra probe traverse at the same time as reading 124 was taken.

Inlet Distortion Performance

Measurements which yielded the overall performance with radial and circumferential distortion screens in place were taken during the first run and are presented in the form of compressor maps in figure 16. It is evident that both distortions had a substantial influence on rotor performance.

In order to compute the total pressure ratio with distortion screens present in the vehicle, the inlet pressure was taken as the arithmetic average of the twenty pressures from the inlet distortion rakes at plane 0.86 (figs. 5 and 6) and the discharge pressure was obtained from equation (2) as in testing with a uniform inlet flow. Likewise, temperatures were obtained as with an undistorted inlet, using equation (1) at discharge. Although the mass-weighting of discharge quantities, using equations (1) and (2), cannot really be justified for a circumferential distortion, the method was judged to be as good as any other that could be easily applied with the available data; the method was therefore retained for consistency.

Data are presented in figure 17(a) to indicate the radial profile and circumferential variations of inlet total pressure, exit total pressure and exit total temperature for design speed with radial distortion. Similar data are presented in figure 17(b) for design speed with circumferential distortion. In this case the large variations of discharge total pressure in the hub region are noteworthy.

As in the testing of Rotor 1B, calculations using maximum and minimum

pressures from the inlet distortion rakes would have yielded higher values of distortion parameter than those expected. As before, boundary layer rake data (fig. 18) showed pressure variations which corresponded to the pitch of the distortion support screen, suggesting that the support screen was choked. Accordingly, the average pressures in the distorted and undistorted regions were used and at design speed a value of about 0.20 was calculated for the distortion parameter, $\frac{P_{\max} - P_{\min}}{P_{\max}}$.

Rotating stall was encountered upon closing the throttle valve and traces were obtained with hot wires at 10%, 50% and 70% immersions. With radial distortion the cells appeared to be qualitatively similar to those encountered during testing with an undistorted inlet. An extensive region of intermittent rotating stall, encountered during running with circumferential distortion at design speed, was accompanied by a gradual deterioration in flow conditions as the throttle valve was closed. At the lower speeds a more distinct stall cell pattern appeared, primarily at the 50% immersion.

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Table 1. - Cascade Projection Data for Rotor 2B Blade Setting.

ψ	$\frac{r_1}{r_t}$	β'_1	i	κ'_1	$\kappa'_{s1} - \kappa'_1$	$\frac{t_{e1}}{c_t}$
1.0	.9959	64.14	3.29	60.85	2.48	.0060
.9	.9597	62.60	3.68	58.92	2.95	.0062
.8	.9227	61.60	4.10	57.50	3.47	.0066
.7	.8840	60.60	4.52	56.08	4.06	.0069
.6	.8434	59.61	4.94	54.67	4.84	.0072
.5	.8005	58.55	5.35	53.20	5.45	.0076
.4	.7540	57.27	5.82	51.45	5.91	.0079
.3	.7046	56.20	6.10	50.10	6.36	.0083
.2	.6492	55.53	6.09	49.44	6.80	.0088
.1	.5850	56.18	5.90	50.28	7.23	.0093
0	.4995	61.18	5.70	55.48	7.56	.0100

ψ	$\frac{r_2}{r_t}$	β'_2	δ°	κ'_2	$\beta'_2 e$	$\frac{t_{e2}}{c_t}$
1.0	.9800	54.58	5.70	48.88	52.91	.0060
.9	.9488	54.20	5.66	48.54	49.94	.0063
.8	.9160	52.77	5.38	47.39	47.54	.0066
.7	.8813	50.75	5.17	45.58	45.02	.0070
.6	.8456	47.97	5.22	42.75	41.83	.0074
.5	.8070	44.05	5.05	39.00	37.76	.0078
.4	.7675	39.12	5.73	33.39	32.78	.0082
.3	.7257	33.36	6.71	26.65	27.15	.0086
.2	.6824	26.32	8.21	18.11	19.68	.0091
.1	.6378	18.34	10.70	7.64	8.52	.0095
0	.5912	10.18	16.82	-6.64	-19.05	.0100

ψ	$\frac{t_m}{c_t}$	γ°	$\frac{a}{c_t}$	σ	ϕ_t
1.0	.0350	58.86	.726	1.3062	11.97
.9	.0387	56.41	.685	1.3523	10.38
.8	.0426	54.32	.642	1.4036	10.11
.7	.0466	52.00	.593	1.4620	10.50
.6	.0510	49.11	.533	1.5280	11.87
.5	.0556	46.10	.500	1.6055	14.20
.4	.0604	42.42	.500	1.6963	18.06
.3	.0655	38.37	.500	1.8044	23.45
.2	.0708	33.77	.500	1.9382	31.33
.1	.0770	28.96	.500	2.1106	42.64
0	.0850	24.42	.500	2.3663	62.12

Table 2 (a) - Overall Performance Based On Fixed Instrumentation

First Run. Flow Straightener Installed

*Rdg.	Total press. ratio	Rotor adiab. eff.	Corrected weight flow lb/sec	Rotor speed, percent design	Throttle valve setting	Operating mode	**Pressure measurement system	Inlet dist.
13T	2.000	.8312	232.72	110.06	10.3	Stall free	Abs.	None
14T	1.375	.7654	225.50	100.06	50.0	Stall free	Abs.	None
15T	1.523	.8149	226.12	100.06	16.0	Stall free	Abs.	None
16T	1.662	.8666	226.40	100.07	13.0	Stall free	Abs.	None
17T	1.701	.8654	225.59	100.07	12.3	Stall free	Abs.	None
18T	1.759	.8811	225.62	100.05	11.4	Stall free	Abs.	None
19T	1.818	.8900	224.62	100.06	10.5	Stall free	Abs.	None
20	1.862	.8851	220.93	100.11	9.6	Stall free	Abs.	None
21T	1.442	.7492	233.80	110.05	50.0	Stall free	Abs.	None
22T	1.716	.7964	234.20	110.14	14.0	Stall free	Abs.	None
23T	1.794	.8100	234.85	110.13	13.0	Stall free	Abs.	None
24T	1.848	.8175	234.40	110.10	12.3	Stall free	Abs.	None
25T	1.892	.8238	231.88	110.11	11.7	Stall free	Abs.	None
26T	1.944	.8299	233.65	110.07	11.0	Stall free	Abs.	None
27T	1.323	.8215	215.48	90.04	50.0	Stall free	Abs.	None
28T	1.494	.9037	216.01	90.06	14.0	Stall free	Abs.	None
29T	1.524	.9045	214.42	90.08	13.0	Stall free	Abs.	None
30T	1.564	.9246	213.30	90.04	12.3	Stall free	Abs.	None
31T	1.636	.9284	209.13	90.03	10.5	Stall free	Abs.	None
32T	1.660	.9389	205.47	90.03	9.7	Stall free	Abs.	None
33	1.681	.9224	200.46	90.03	8.7	Stall free	Abs.	None
34	1.563	.9382	213.64	90.02	12.3	Stall free	Abs.	None
35	1.699	.8763	225.44	99.99	12.3	Stall free	Abs.	None
36T	1.113	.9572	145.2	49.99	50.0	Stall free	Diff.	None
37T	1.122	.9454	138.8	49.95	25.0	Stall free	Diff.	None
38T	1.133	.9476	133.4	50.01	18.0	Stall free	Diff.	None
39T	1.139	.9343	129.4	50.04	15.0	Stall free	Diff.	None
40	1.145	.9328	125.0	49.98	12.3	Stall free	Diff.	None
41T	1.145	.9342	125.0	49.93	12.3	Stall free	Diff.	None
42T	1.161	.8868	111.2	50.04	7.0	Stall free	Diff.	None
43T	1.170	.8738	97.4	50.06	3.8	Stall free	Diff.	None
44T	1.211	.8620	185.8	69.99	50.0	Stall free	Diff.	None
45T	1.282	.9249	181.0	69.95	15.0	Stall free	Diff.	None
46T	1.305	.9319	176.8	70.00	12.3	Stall free	Diff.	None
47T	1.317	.9383	174.0	69.98	11.0	Stall free	Diff.	None
48T	1.339	.9371	167.8	70.00	9.0	Stall free	Diff.	None
49T	1.353	.9024	159.2	70.05	7.3	Stall free	Diff.	None
50T	1.354	.8710	151.0	70.05	5.5	Stall free	Diff.	None
51	1.133	.7104	94.5	50.02	3.0	Stalled	Abs.	None
52T	1.676	.9055	200.01	90.03	8.7	Stall free	Abs.	None
53T	1.864	.8821	221.05	100.06	9.6	Stall free	Abs.	None

*The letter "T" following the reading number indicates Blade Element Performance data were recorded.

**Abs. - Instrumentation arranged to record absolute pressure at rotor inlet and exit.

Diff. - Instrumentation arranged to record difference between rotor inlet and exit pressures.

Table 2 (a) - Overall Performance Based On Fixed Instrumentation (continued).

First Run. Flow Straightener Installed

*Rdg.	Total press ratio	Rotor adiab. eff.	Corrected weight flow lb/sec	Rotor speed, percent design	Throttle valve setting	Operating mode	**Pressure measurement system	Inlet dist.
54	1.856	.8168	234.68	110.00	12.3	Stall free	Abs.	None
55	1.685	.7519	195.31	100.07	8.5	Stalled	Abs.	None
56	1.789	.8784	225.08	100.09	11.0	Stall free	Abs.	None
57	1.820	.7066	200.45	110.05	8.9	Stalled	Abs.	None
58	1.967	.8292	233.93	110.03	10.8	Stall free	Abs.	None
59	1.567	.7732	177.76	90.06	7.3	Stalled	Abs.	None
60	1.636	.9175	209.97	90.07	10.6	Stall free	Abs.	None
61	1.296	.7275	132.5	70.07	4.2	Stalled	Abs.	None
62	1.348	.9307	164.02	70.07	8.3	Stall free	Abs.	None
80	1.288	.9371	179.71	70.05	50.0	Stall free	Abs.	Radial
81	1.413	.8178	208.50	90.14	50.0	Stall free	Abs.	Radial
82	1.463	.7716	218.00	100.12	50.0	Stall free	Abs.	Radial
83	1.705	.8105	213.87	100.08	17.0	Stall free	Abs.	Radial
84	1.669	.8173	216.95	99.99	18.7	Stall free	Abs.	Radial
85	1.621	.8070	217.39	100.06	20.5	Stall free	Abs.	Radial
86	1.554	.7875	217.40	100.10	25.0	Stall free	Abs.	Radial
87	1.575	.8603	202.86	90.09	17.0	Stall free	Abs.	Radial
88	1.543	.8651	205.98	90.08	18.3	Stall free	Abs.	Radial
89	1.513	.8462	205.96	90.11	20.0	Stall free	Abs.	Radial
90	1.486	.8581	208.49	90.09	24.0	Stall free	Abs.	Radial
91	1.299	.9453	178.06	70.04	31.0	Stall free	Abs.	Radial
92	1.310	.9133	175.15	70.05	24.0	Stall free	Abs.	Radial
93	1.322	.9289	171.31	70.08	19.0	Stall free	Abs.	Radial
94	1.336	.9071	165.89	70.06	15.6	Stall free	Abs.	Radial
95	1.274	.9007	174.11	70.01	50.0	Stall free	Abs.	Circum.
96	1.486	.8472	206.17	89.99	50.0	Stall free	Abs.	Circum.
97	1.596	.7942	217.82	100.07	50.0	Stall free	Abs.	Circum.
98	1.682	.8168	212.81	100.02	18.0	Stall free	Abs.	Circum.
99	1.634	.8008	215.63	100.06	25.0	Stall free	Abs.	Circum.
100	1.649	.8000	214.49	100.04	22.0	Stall free	Abs.	Circum.
101	1.661	.8256	215.33	100.02	20.0	Stall free	Abs.	Circum.
102	1.710	.8186	211.09	100.03	16.0	Stall free	Abs.	Circum.
103	1.588	.8626	196.71	90.05	14.0	Stall free	Abs.	Circum.
104	1.514	.8221	203.60	90.05	25.0	Stall free	Abs.	Circum.
105	1.544	.8322	201.63	90.05	19.0	Stall free	Abs.	Circum.
106	1.567	.8487	198.90	90.04	16.0	Stall free	Abs.	Circum.
107	1.347	.8008	144.63	70.01	9.0	Stall free	Abs.	Circum.
108	1.293	.8445	170.63	70.00	25.0	Stall free	Abs.	Circum.
109	1.322	.9232	161.94	70.01	15.0	Stall free	Abs.	Circum.
110	1.338	.8181	151.95	70.01	11.0	Stall free	Abs.	Circum.

*The letter "T" following the reading number indicates Blade Element Performance data were recorded.

**Abs. - Instrumentation arranged to record absolute pressure at rotor inlet and exit.

Diff. - Instrumentation arranged to record difference between rotor inlet and exit pressures.

Table 2 (b) - Overall Performance Based On Fixed Instrumentation

Second Run. Flow Straightener Removed

*Rdg.	Total press ratio	Rotor adiab. eff.	Corrected weight flow lb/sec	Rotor speed, percent design	Throttle valve setting	Operating mode	**Pressure measurement system	Inlet dist.
111	1.144	.9165	122.25	50.01	11.7	Stall free	Abs.	None
112	1.214	.9113	151.86	60.05	11.7	Stall free	Abs.	None
113	1.304	.9291	173.16	70.05	11.7	Stall free	Abs.	None
114	1.358	.9310	184.07	75.01	11.7	Stall free	Abs.	None
115	1.576	.9047	210.79	90.13	11.7	Stall free	Abs.	None
116	1.725	.8564	223.56	100.01	11.7	Stall free	Abs.	None
117	1.795	.8699	220.80	100.12	10.5	Stall free	Abs.	None
118	1.683	.8443	223.48	100.07	12.3	Stall free	Abs.	None
119	1.873	.8090	232.01	110.13	11.7	Stall free	Abs.	None
120	1.516	.8099	225.33	99.99	16.0	Stall free	Abs.	None
121	1.645	.8466	224.16	100.03	13.0	Stall free	Abs.	None
122	1.695	.8504	223.25	100.09	12.3	Stall free	Abs.	None
123	1.747	.8685	223.72	100.03	11.4	Stall free	Abs.	None
124T	1.806	.8754	221.50	100.15	10.5	Stall free	Abs.	None
125T	1.856	.8810	219.72	100.00	9.6	Stall free	Abs.	None
126T	1.370	.7545	223.70	99.96	50.0	Stall free	Abs.	None
127	1.309	.7696	213.41	90.12	50.0	Stall free	Abs.	None
128	1.479	.8684	213.37	90.07	14.0	Stall free	Abs.	None
129	1.513	.8827	213.54	90.03	13.0	Stall free	Abs.	None
130	1.543	.8884	213.27	90.01	12.5	Stall free	Abs.	None
131	1.628	.9106	208.10	89.94	10.5	Stall free	Abs.	None
132	1.651	.9124	203.97	89.87	9.7	Stall free	Abs.	None
133	1.669	.9015	199.27	89.84	8.7	Stall free	Abs.	None
134	1.437	.7257	231.99	110.09	50.0	Stall free	Abs.	None
135	1.712	.7880	232.98	110.13	14.0	Stall free	Abs.	None
136	1.789	.8088	232.99	110.07	13.0	Stall free	Abs.	None
137	1.842	.8232	233.38	110.03	12.3	Stall free	Abs.	None
138	1.888	.8289	233.25	110.11	11.7	Stall free	Abs.	None
139	1.928	.8256	231.87	109.95	11.0	Stall free	Abs.	None
140	1.983	.8300	230.94	109.92	10.3	Stall free	Abs.	None
141	1.515	.8014	224.62	99.95	16.0	Stall free	Abs.	None
142	1.692	.8567	224.37	100.01	12.3	Stall free	Abs.	None
143	1.806	.8797	221.97	100.02	10.5	Stall free	Abs.	None

*The letter "T" following the reading number indicates Blade Element Performance data were recorded.

**Abs. - Instrumentation arranged to record absolute pressure at rotor inlet and exit.

Diff. - Instrumentation arranged to record difference between rotor inlet and exit pressures.

Table 2 (c). - Overall Performance Based On Fixed Instrumentation

Final Run. Flow Straightener Removed

*Rdg.	Total press ratio	Rotor adiab. eff.	Corrected weight flow lb/sec	Rotor speed, percent design	Throttle valve setting	Operating mode	**Pressure measurement system	Inlet dist.
150	1.370	.7593	224.37	100.02	50.0	Stall free	Abs.	None
151	1.515	.7980	224.26	100.13	16.0	Stall free	Abs.	None
152	1.687	.8515	223.83	100.09	12.3	Stall free	Abs.	None
153	1.743	.8666	222.67	100.11	11.4	Stall free	Abs.	None
154	1.805	.8765	222.11	100.14	10.5	Stall free	Abs.	None
155	1.854	.8840	219.20	100.07	9.6	Stall free	Abs.	None

Table 2 (d) - Overall Performance Based On Fixed Instrumentation

Final Run. Flow Straightener Installed

Rdg.*	Total press ratio	Rotor adiab. eff.	Corrected weight flow lb/sec	Rotor speed, percent design	Throttle valve setting	Operating mode	**Pressure measurement system	Inlet dist.
156T	1.375	.7746	223.78	99.51	50.0	Stall free	Abs.	None
157	1.520	.8117	224.19	100.04	16.0	Stall free	Abs.	None
158	1.648	.8522	224.51	100.04	13.0	Stall free	Abs.	None
159	1.697	.8583	223.66	100.16	12.3	Stall free	Abs.	None
160	1.757	.8728	223.80	100.21	11.4	Stall free	Abs.	None
161T	1.813	.8807	221.55	100.17	10.5	Stall free	Abs.	None
162T	1.858	.8862	219.22	100.16	9.6	Stall free	Abs.	None
163	1.446	.7448	232.87	110.27	50.0	Stall free	Abs.	None
164	1.720	.7944	233.15	110.20	14.0	Stall free	Abs.	None
165	1.796	.8091	233.06	110.18	13.0	Stall free	Abs.	None
166	1.849	.8183	232.72	110.14	12.3	Stall free	Abs.	None
167	1.894	.8177	232.90	110.22	11.7	Stall free	Abs.	None
168	1.939	.8232	232.24	110.16	11.0	Stall free	Abs.	None
169	1.990	.8233	231.08	110.20	10.3	Stall free	Abs.	None
170	1.316	.7977	213.22	90.10	50.0	Stall free	Abs.	None
171	1.485	.8732	213.41	90.44	14.0	Stall free	Abs.	None
172	1.525	.8904	213.23	90.27	13.0	Stall free	Abs.	None
173	1.563	.9075	212.36	90.26	12.3	Stall free	Abs.	None
174	1.592	.9054	211.04	90.20	11.5	Stall free	Abs.	None
175	1.630	.9142	207.70	90.25	10.5	Stall free	Abs.	None
176	1.652	.9040	203.99	90.03	9.7	Stall free	Abs.	None
177	1.671	.9059	198.62	89.88	8.7	Stall free	Abs.	None
178	1.699	.8646	224.63	100.16	12.3	Stall free	Abs.	None
179	1.811	.8836	222.12	100.13	10.5	Stall free	Abs.	None
180	1.859	.8835	219.43	100.13	9.6	Stall free	Abs.	None

*The letter "T" following the reading number indicates Blade Element Performance data were recorded.

**Abs. - Instrumentation arranged to record absolute pressure at rotor inlet and exit.

Diff. - Instrumentation arranged to record difference between rotor inlet and exit pressures.

Table 3. - Constants Used in Data Analysis Methods
Columns list data in order of increasing immersion number

Parameter	Plane 0.95	Edge 1	Edge 2	Plane 1.51	Plane 1.57		
A_j	1.3108 1.1849 1.0814 1.0567 1.0967			1.0320 .9483 .8661 .7831 .7001	1.0067 .9206 .8285 .7593 .7043	$\left(\frac{w}{w^*}\right)_1$	1.0906 1.0762 1.0709 1.0802 1.0582
r_j^+	18.323 17.473 15.733 14.023 12.191 10.023 8.550	18.182 17.392 15.759 14.180 12.456 10.494 9.116	17.887 17.201 15.768 14.354 12.921 11.516 10.789	17.838 17.148 15.770 14.391 13.012 11.634 10.944	17.836 17.166 15.817 14.501 13.198 11.864 11.169	$\left(\frac{w}{w^*}\right)_2$.9827 .9720 .9696 .9745 .9794
ϵ_j°	-1.57 1.85 6.10 11.76 20.40	-4.50 1.00 5.70 12.25 22.20	-4.00 -0.50 3.00 7.00 13.40	-.68 .28 2.51 5.68 9.72	-.07 .32 .42 .33 .13	\bar{r}_j (Used for Diffusion Factor)	17.283 15.768 14.272 12.738 11.023
$\kappa_j^\circ (s_j^\circ)$		58.64 (61.68) 55.33 (59.74) 52.25 (57.96) 49.71 (56.28) 50.60 (57.88)	48.36 44.29 36.17 23.45 5.78			σ_j (Used for Diffusion Factor)	1.363 1.494 1.650 1.849 2.136

[†] first and last values are casing and hub radii, respectively.

Radii are in inches.
Areas are in square feet.

Frontal Area = 7.2660
Annulus Area = 5.4495

Table 4. - Listing of Check Case for Blade Element Results Using Design Data.

N.A.S.A. COMPRESSOR OUTPUT DATA BLADE ELEMENT PERFORMANCE RESULTS										
	POINT NUMBER	1	READING NUMBER	1	DATE	4/14/1967				
RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMHR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY	
1	62.625	3.985	0.945	1.4012	1503.455	1334.214	693.000	0.646	690.864	
2	60.159	4.029	0.419	1.2991	1393.785	1208.940	693.614	0.646	693.508	
3	57.957	5.707	-0.003	1.1964	1285.123	1087.808	684.262	0.637	680.879	
4	55.725	6.010	-0.555	1.0823	1164.969	955.553	666.387	0.619	651.214	
5	56.874	6.274	-1.006	0.9055	984.885	805.039	567.370	0.522	525.312	
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY	
1	54.224	5.864	8.401	0.8332	985.726	1319.562	777.226	0.657	575.793	
2	49.376	5.080	10.784	0.7555	864.366	1209.630	789.432	0.670	562.776	
3	41.761	5.591	16.196	0.6467	757.839	1101.156	822.263	0.702	564.862	
4	39.561	7.111	25.165	0.5993	695.226	991.225	876.914	0.756	595.334	
5	17.164	11.384	39.710	0.6221	709.745	883.441	960.912	0.842	661.221	
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO		
1	0.471	0.33999	0.4555	0.	520.502	1334.214	799.060	0.833		
2	0.213	0.41049	0.4987	0.	553.591	1208.940	656.040	0.811		
3	0.252	0.47039	0.5299	0.	596.801	1087.808	504.356	0.830		
4	0.254	0.51484	0.5276	0.	639.696	955.553	351.529	0.914		
5	0.448	0.47302	0.3837	0.	679.209	805.039	204.233	1.259		
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.			
1	0.7901	0.8116	1.760	1.220		0.	42.113			
2	0.8177	0.8316	1.760	1.215		0.	44.529			
3	0.8321	0.8449	1.760	1.211		0.	46.575			
4	0.8628	0.8733	1.760	1.203		0.	47.057			
5	0.9106	0.9174	1.760	1.193		0.	45.769			
TRAVERSE PRESSURE RATIO	= 1.7600	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.7600						
TRAVERSE ADIABATIC EFF.	= 0.8576		ADIABATIC EFF.	= 0.8370						
TRAVERSE POLYTROPIC EFF.	= 0.8500		POLYTROPIC EFF.	= 0.8500						
FLOW COEFFICIENT L.E.	= 0.980		NOZZLE WEIGHT FLOW	= 215.49						
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.00324							
		T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.00408							

Table 5. - Simulated Listing for Symbolic Identification of Column Headings.

RADIAL POSITION	REL. INLET FLOW ANG., MN.CMBR.LN	INCID ANG SUET,SURF	INLET REL MACH NO.	INLET REL VELOCITY	MOTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1								
2								
3	β_1'	i	$\beta_1' - \kappa_{s1}'$	M_1'	v_1'	u_1	v_1	M_1
4								
5								

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	MOTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1									
2									
3	β_2'	δ°	$\Delta\beta^\circ$	M_2'	v_2'	u_2	v_2	M_2	v_{z2}
4									
5									

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CW1	INLET ABS TANG. VEL	EXIT ABS TANG.VEL	INLET REL TANG. VEL	EXIT REL TANG.VEL	AXIAL VEL.RATIO
1								
2								
3	D	c_p	c_h	$v_{\theta 1}$	$v_{\theta 2}$	$v_{\theta 1}'$	$v_{\theta 2}'$	$\frac{v_{z2}}{v_{z1}}$
4								
5								

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS.EXIT FLOW ANG.
1						
2						
3	n_{ad}	n_p	$\frac{P_{1.51}}{P_{0.95}}$	$\frac{T_{1.51}}{T_{0.95}}$	β_1	β_2
4						
5						

TRAVERSE PRESSURE RATIO	=	FIXED INSTRUMENTATION	PRESSURE RATIO	=
TRAVERSE ADIABATIC EFF.	=		ADIABATIC EFF.	=
TRAVERSE POLYTROPIC EFF.	=		POLYTROPIC EFF.	=
FLOW COEFFICIENT L.E.	=		NOZZLE WEIGHT FLOW	=
FLOW COEFFICIENT T.E.	=	L.E. CHECK WEIGHT FLOW/NOZ.	WEIGHT FLOW	=
		T.E. CHECK WEIGHT FLOW/NOZ.	WEIGHT FLOW	=

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1					
2					
3	$\frac{\bar{w}' \cos \beta_2'}{2\sigma}$	n_{ad}	\bar{w}'	$\frac{P_{1.57}}{P_{0.05}}$	$\frac{T_{1.57}}{T_{0.05}}$
4					
5					

Table 6. - Listing of Blade Element Performance.

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 3 READING NUMBER 13 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.754	4.114	1.074	1.5486	1652.744	1468.419	758.492	0.711	756.154
2	59.946	4.616	0.206	1.4466	1537.273	1330.544	769.975	0.725	769.858
3	57.670	5.420	-0.290	1.3354	1418.892	1197.227	761.513	0.717	757.748
4	55.340	5.630	-0.940	1.2109	1288.275	1051.669	744.074	0.699	727.132
5	56.069	5.469	-1.811	1.0168	1095.221	886.016	643.806	0.598	596.081
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	50.572	2.212	12.182	0.7809	949.666	1452.293	939.402	0.772	602.547
2	45.828	1.538	14.118	0.7467	891.591	1331.303	929.845	0.779	621.262
3	44.160	7.990	13.510	0.5669	679.946	1211.918	885.288	0.738	487.450
4	23.092	-0.358	32.248	0.6304	735.401	1090.929	1051.480	0.901	672.205
5	17.890	12.110	38.179	0.5966	690.162	972.304	1009.767	0.873	640.537
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL		AXIAL VEL.RATIO
1	0.584	0.31894	0.4509	0.	719.471	1468.419	732.822	0.797	
2	0.571	0.40534	0.5108	0.	691.821	1330.544	639.483	0.807	
3	0.679	0.48311	0.5577	0.	738.563	1197.227	473.356	0.643	
4	0.600	0.50209	0.5292	0.	804.324	1051.669	286.605	0.924	
5	0.541	0.55497	0.4772	0.	765.543	886.016	206.761	1.075	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7067	0.7346	2.052	1.323		0.	50.054		
2	0.8203	0.8377	2.076	1.283		0.	48.076		
3	0.7488	0.7712	1.960	1.283		0.	56.575		
4	0.8709	0.8837	2.117	1.275		0.	50.113		
5	0.8742	0.8855	1.957	1.242		0.	50.080		
TRAVERSE PRESSURE RATIO = 2.0388				FIXED INSTRUMENTATION PRESSURE RATIO = 2.0000					
TRAVERSE ADIABATIC EFF. = 0.7951				ADIABATIC EFF. = 0.8312					
TRAVERSE POLYTROPIC EFF. = 0.8145				POLYTROPIC EFF. = 0.8468					
FLOW COEFFICIENT L.E. = 0.980				NOZZLE WEIGHT FLOW = 232.72					
FLOW COEFFICIENT T.E. = 0.950				L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98715					
PERCENT DESIGN SPEED = 110				T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.97571					

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0636	0.7206	0.2731	1.983	1.300
2	0.0411	0.8267	0.1764	2.043	1.274
3	0.0457	0.8924	0.2103	1.943	1.261
4	0.0368	0.8756	0.1479	1.998	1.250
5	0.0188	0.9413	0.0844	1.972	1.227

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 4 READING NUMBER 14 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.536	2.896	-0.144	1.4190	1519.753	1335.095	726.065	0.678	723.826
2	58.785	3.455	-0.955	1.3240	1414.581	1209.738	733.194	0.686	733.083
3	56.541	4.291	-1.419	1.2235	1306.728	1088.526	722.944	0.677	719.369
4	54.122	4.412	-2.158	1.1121	1189.600	956.184	707.715	0.662	691.601
5	54.748	4.148	-3.132	0.9369	1013.463	805.571	614.949	0.569	569.363
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.984	6.624	6.551	1.1748	1305.063	1320.433	791.417	0.712	748.245
2	52.252	7.962	6.532	1.0450	1171.974	1210.429	771.549	0.688	717.453
3	47.438	11.268	9.102	0.8796	997.297	1101.883	768.745	0.678	674.132
4	29.114	5.664	25.008	0.8859	982.360	991.879	1003.038	0.904	853.344
5	13.487	7.707	41.261	0.8718	950.970	884.025	1141.857	1.047	900.888
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AxIAL VEL.RATIO	
1	0.202	0.09209	0.1552	0.	252.453	1335.095	1067.980	1.034	
2	0.239	0.15533	0.2140	0.	283.743	1209.738	926.686	0.979	
3	0.323	0.20170	0.2450	0.	367.786	1088.526	734.097	0.937	
4	0.293	0.17312	0.1692	0.	516.634	956.184	475.245	1.234	
5	0.223	-0.00373	-0.1337	0.	667.963	805.571	216.061	1.582	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS	TOT. TEMP		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7615	0.7688	1.247	1.086		0.	18.644		
2	0.7386	0.7479	1.291	1.103		0.	21.578		
3	0.6177	0.6318	1.304	1.128		0.	28.616		
4	0.8495	0.8582	1.523	1.151		0.	31.192		
5	0.8725	0.8807	1.602	1.166		0.	36.555		

TRAVERSE PRESSURE RATIO = 1.3806 FIXED INSTRUMENTATION PRESSURE RATIO = 1.3750
 TRAVERSE ADIABATIC EFF. = 0.7794 ADIABATIC EFF. = 0.7654
 TRAVERSE POLYTROPIC EFF. = 0.7892 POLYTROPIC EFF. = 0.7757
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 225.50
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.99235
 PERCENT DESIGN SPEED = 100 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.99659

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0263	0.6873	0.1249	1.236	1.091
2	0.0362	0.6670	0.1765	1.294	1.115
3	0.0401	0.6705	0.1958	1.303	1.117
4	0.0172	0.9106	0.0730	1.524	1.140
5	0.0364	0.8611	0.1601	1.563	1.158

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 5 READING NUMBER 15 DATE 5/11/1967

RADIAL POSITION	RFL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.355	2.715	-0.325	1.4211	1522.277	1335.017	731.477	0.683	729.222
2	58.657	3.327	-1.083	1.3263	1416.411	1209.667	736.836	0.690	736.724
3	56.752	4.502	-1.208	1.2187	1303.454	1088.462	717.108	0.670	713.562
4	54.768	5.058	-1.512	1.1007	1179.696	956.127	691.017	0.645	675.283
5	55.368	4.768	-2.512	0.9280	1004.961	805.523	600.898	0.555	556.353
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	55.186	6.826	6.170	1.0185	1170.921	1320.355	760.140	0.661	667.970
2	50.683	6.393	7.975	0.9061	1040.542	1210.358	773.958	0.674	659.291
3	48.274	12.104	8.478	0.7271	841.608	1101.819	734.157	0.634	559.804
4	28.100	4.650	26.668	0.7929	892.798	991.821	975.442	0.866	782.981
5	12.956	7.176	42.413	0.8009	885.414	883.973	1106.122	1.001	840.519
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.317	0.20901	0.3082	0.	359.787	1335.017	960.568	0.916	
2	0.361	0.28102	0.3640	0.	405.355	1209.667	805.003	0.895	
3	0.465	0.30704	0.3642	0.	474.074	1088.462	627.745	0.785	
4	0.377	0.28711	0.2969	0.	573.746	956.127	418.074	1.159	
5	0.287	0.08671	-0.0266	0.	690.608	805.523	193.364	1.511	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7643	0.7763	1.449	1.147		0.	28.308		
2	0.8143	0.8248	1.505	1.152		0.	31.585		
3	0.6413	0.6583	1.412	1.162		0.	40.260		
4	0.8762	0.8845	1.636	1.173		0.	36.233		
5	0.8421	0.8527	1.635	1.180		0.	39.408		
TRAVESE PRESSURE RATIO	= 1.5246	FIXED INSTRUMENTATION PRESSURE RATIO	= 1.5230						
TRAVESE ADIABATIC EFF.	= 0.7946	ADIABATIC EFF.	= 0.8149						
TRAVESE POLYTROPIC EFF.	= 0.8065	POLYTROPIC EFF.	= 0.8256						
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 226.12						
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98428						
PERCENT DESIGN SPEED	= 100	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98033						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0372	0.7109	0.1778	1.425	1.150
2	0.0314	0.7886	0.1482	1.502	1.156
3	0.0388	0.7422	0.1924	1.450	1.151
4	0.0157	0.9294	0.0658	1.630	1.161
5	0.0340	0.8786	0.1490	4.615	1.167

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 6 READING NUMBER 16 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT,SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.631	2.991	-0.049	1.4172	1518.452	1335.160	723.216	0.675	720.987
2	58.800	3.470	-0.940	1.3244	1414.425	1209.797	732.796	0.686	732.684
3	56.582	4.332	-1.378	1.2222	1306.169	1088.580	721.854	0.675	718.285
4	54.189	4.479	-2.091	1.1111	1188.628	956.230	706.016	0.660	689.941
5	55.157	4.557	-2.723	0.9316	1007.922	805.610	605.721	0.560	560.819

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.871	6.511	6.760	0.9022	1058.312	1320.498	761.360	0.649	608.478
2	49.188	4.898	9.612	0.8353	970.031	1210.488	793.008	0.683	633.988
3	45.036	8.866	11.546	0.6416	751.416	1101.937	779.726	0.666	530.635
4	29.879	6.429	24.310	0.6851	784.969	991.928	910.312	0.794	676.804
5	15.278	9.498	39.878	0.6830	770.400	884.068	1012.554	0.898	724.291

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO
1	0.413	0.2817	0.3993	0.	455.646	1335.160	864.851	0.844
2	0.427	0.36411	0.4539	0.	476.329	1209.797	734.159	0.865
3	0.558	0.40786	0.4709	0.	570.637	1088.580	531.300	0.739
4	0.479	0.45036	0.4693	0.	603.075	956.230	388.853	0.981
5	0.402	0.32293	0.2382	0.	686.217	805.610	197.851	1.291

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.7623	0.7778	1.613	1.192	0.	36.827
2	0.8718	0.8807	1.674	1.182	0.	36.918
3	0.7187	0.7366	1.597	1.199	0.	47.080
4	0.8910	0.8991	1.725	1.190	0.	41.703
5	0.8624	0.8723	1.694	1.189	0.	43.454

TRAVERSE PRESSURE RATIO	= 1.6599	FIXED INSTRUMENTATION PRESURE RATIO	= 1.6620
TRAVERSE ADIABATIC EFF.	= 0.8210	ADIABATIC EFF.	= 0.8666
TRAVERSE POLYTROPIC EFF.	= 0.8333	POLYTROPIC EFF.	= 0.8758
FLOW COEFFICIENT L.E.	= 0.980	NOZZE WEIGHT FLOW	= 226.40
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98535
PERCENT DESIGN SPEED	= 100	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.96968

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0400	0.7455	0.1894	1.580	1.187
2	0.0265	0.8501	0.1210	1.657	1.183
3	0.0360	0.8071	0.1682	1.609	1.180
4	0.0106	0.9545	0.0453	1.720	1.176
5	0.0212	0.9261	0.0940	1.684	1.173

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 7 READING NUMBER 17 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.584	2.944	-0.096	1.4202	1523.641	1339.129	726.783	0.677	724.543
2	58.787	3.457	-0.953	1.3265	1418.822	1213.394	735.345	0.688	735.233
3	56.739	4.489	-1.221	1.2219	1307.674	1091.815	719.688	0.672	716.129
4	54.485	4.775	-1.795	1.1077	1187.604	959.073	700.415	0.653	684.468
5	55.462	4.862	-2.418	0.9281	1006.795	808.005	600.637	0.554	556.112
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T,E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.550	6.190	7.035	0.8717	1029.199	1324.423	770.953	0.653	596.443
2	49.548	4.258	10.239	0.8085	944.096	1214.087	804.454	0.689	624.971
3	43.284	7.114	13.455	0.6254	735.747	1105.213	805.355	0.685	535.205
4	29.448	5.998	25.038	0.6692	770.234	994.876	913.152	0.793	666.920
5	16.645	10.865	38.817	0.6382	726.428	886.696	976.820	0.858	678.539
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	Axial. VEL.RATIO	
1	0.441	0.30889	0.4238	0.	486.708	1339.129	837.715	0.823	
2	0.454	0.38839	0.4794	0.	506.485	1213.394	707.601	0.850	
3	0.577	0.43995	0.5032	0.	601.137	1091.815	504.076	0.747	
4	0.494	0.48143	0.4993	0.	618.351	959.073	376.526	0.974	
5	0.445	0.40297	0.3201	0.	683.836	808.005	202.860	1.220	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.			
1	0.7673	0.7834	1.667	1.205	0.	39.215			
2	0.8781	0.8872	1.730	1.193	0.	39.022			
3	0.7468	0.7645	1.676	1.213	0.	48.321			
4	0.9023	0.9098	1.770	1.197	0.	42.836			
5	0.8638	0.8737	1.707	1.191	0.	45.223			

TRAVERSE PRESSURE RATIO = 1.7096 FIXED INSTRUMENTATION PRESSURE RATIO = 1.7010
 TRAVERSE ADIABATIC EFF. = 0.8296 ADIABATIC EFF. = 0.8654
 TRAVERSE POLYTROPIC EFF. = 0.8420 POLYTROPIC EFF. = 0.8751
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 225.59
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98522
 PERCENT DESIGN SPEED = 100 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.97291

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0420	0.7486	0.1976	1.633	1.201
2	0.0258	0.8623	0.1165	1.715	1.193
3	0.0349	0.8295	0.1583	1.685	1.194
4	0.0093	0.9619	0.0395	1.761	1.183
5	0.0248	0.9148	0.1107	1.693	1.177

Table 6. - Listing of Blade Element Performance (continued).
NASA - TASK I (ROTOR 2B)

N.A.S.tA, COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 8 READING NUMBER 18 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.861	3.221	0.181	1.4118	1514.916	1334.938	716.179	0.667	713.971
2	58.906	3.576	-0.834	1.3215	1412.601	1209.596	729.603	0.683	729.492
3	56.688	4.438	-1.272	1.2200	1304.345	1088.398	718.823	0.672	715.268
4	54.342	4.632	-1.938	1.1084	1186.078	956.071	701.932	0.656	685.950
5	55.161	4.561	-2.719	0.9311	1007.688	805.476	605.511	0.559	560.625
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.268	4.908	8.593	0.8333	991.049	1320.278	793.626	0.667	592.206
2	47.785	3.495	11.122	0.7646	896.794	1210.286	813.234	0.693	602.564
3	42.206	6.036	14.482	0.6017	709.065	1101.754	817.179	0.693	524.831
4	29.989	6.539	24.353	0.6417	741.203	991.762	895.679	0.775	638.372
5	17.150	11.370	38.012	0.5823	666.432	383.920	941.652	0.823	620.915
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.473	0.33605	0.4524	0.	526./06	1334.938	793.571	0.829	
2	0.495	0.42236	0.5133	0.	546.112	1209.596	664.175	0.826	
3	0.603	0.48792	0.5501	0.	625./61	1088.398	475.993	0.734	
4	0.519	0.54304	0.5590	0.	623.361	956.071	368.402	0.931	
5	0.507	0.50073	0.4196	0.	692.310	805.476	191.611	1.108	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7557	0.7741	1.751	1.230		0.	41.650		
2	0.8781	0.8877	1.800	1.209		0.	42.186		
3	0.7883	0.8044	1.759	1.222		0.	50.013		
4	0.9163	0.9231	1.815	1.203		0.	44.318		
5	0.8710	0.8806	1.735	1.196		0.	48.112		

TRAVERSE PRESSURE RATIO = 1.7735 FIXED INSTRUMENTATION PRESSURE RATIO = 1.7590
 TRAVERSE ADIABATIC EFF. = 0.8358 ADIABATIC EFF. = 0.8811
 TRAVERSE POLYTROPIC EFF. = 0.8485 POLYTROPIC EFF. = 0.8902
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 225.62
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98522
 PERCENT DESIGN SPEED = 100 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.96796

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0438	0.7633	0.1996	1.712	1.218
2	0.0240	0.8802	0.1069	1.784	1.204
3	0.0311	0.8580	0.1386	1.760	1.204
4	0.0064	0.9745	0.0272	1.809	1.189
5	0.0232	0.9209	0.1037	1.710	1.180

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 9 READING NUMBER 19 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT,SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.829	3.189	0.149	1.4121	1515.450	1335.006	717.180	0.668	714.969
2	59.048	3.718	-0.692	1.3182	1410.567	1209.657	725.553	0.678	725.443
3	56.960	4.710	-1.000	1.2144	1300.345	1088.454	711.454	0.664	707.936
4	54.829	5.119	-1.451	1.0989	1178.772	956.120	689.448	0.643	673.750
5	55.822	5.222	-2.058	0.9209	998.935	805.517	590.774	0.545	546.981

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	51.888	3.528	9.941	0.7769	930.768	1320.345	823.151	0.687	573.939
2	46.912	2.622	12.137	0.7292	859.701	1210.348	827.185	0.702	587.269
3	41.565	5.395	15.395	0.5916	698.688	1101.810	825.486	0.699	522.359
4	29.386	5.936	25.443	0.6050	701.119	991.813	892.587	0.770	607.445
5	17.938	12.158	37.884	0.5536	636.220	883.966	921.042	0.801	590.320

RADIAL POSITION	DIFFUSION FACTOR	ST. PRES RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO
1	0.528	0.36707	0.4853	0.	588.695	1335.006	731.650	0.803
2	0.529	0.45578	0.5460	0.	582.516	1209.657	627.833	0.810
3	0.612	0.52460	0.5845	0.	638.607	1088.454	463.203	0.738
4	0.556	0.57116	0.5840	0.	649.738	956.120	342.076	0.902
5	0.533	0.55923	0.4732	0.	692.865	805.517	191.100	1.079

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.7581	0.7780	1.851	1.254	0.	45.727
2	0.8870	0.8966	1.877	1.223	0.	44.767
3	0.8233	0.8376	1.826	1.228	0.	50.718
4	0.9270	0.9330	1.847	1.207	0.	46.927
5	0.8891	0.8976	1.757	1.197	0.	49.569

TRAVERSE PRESSURE RATIO = 1.8368 FIXED INSTRUMENTATION PRESSURE RATIO = 1.8180
 TRAVERSE ADIABATIC EFF. = 0.8475 ADIABATIC EFF. = 0.8900
 TRAVERSE POLYTROPIC EFF. = 0.8599 POLYTROPIC EFF. = 0.8989
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 224.62
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98301
 PERCENT DESIGN SPEED = 100 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.96477

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0466	0.7708	0.2057	1.792	1.235
2	0.0234	0.8912	0.1022	1.855	1.217
3	0.0293	0.8735	0.1292	1.821	1.214
4	0.0074	0.9717	0.0314	1.840	1.196
5	0.0182	0.9394	0.0819	1.740	1.183

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 11 READING NUMBER 21 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.011	3.371	0.331	1.5647	1663.983	1468.357	782.795	0.736	780.382
2	59.512	4.182	-0.228	1.4544	1544.028	1330.487	783.472	0.738	783.353
3	57.374	5.124	-0.586	1.3402	1423.534	1197.177	770.206	0.725	766.398
4	55.216	5.506	-1.064	1.2116	1290.213	1051.624	747.486	0.702	730.466
5	56.220	5.620	-1.660	1.0129	1093.021	885.978	640.107	0.593	592.657
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.865	6.505	7.146	1.2860	1430.895	1452.231	872.023	0.784	822.818
2	53.050	8.760	6.462	1.1275	1268.506	1331.247	826.008	0.734	762.512
3	51.153	14.983	6.220	0.9192	1054.144	1211.867	768.790	0.670	660.842
4	24.335	0.885	30.881	0.8751	962.906	1090.883	1121.117	1.019	871.917
5	13.043	7.263	43.178	0.8579	942.762	972.263	1196.283	1.089	894.662
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO	
1	0.202	0.07842	0.1454	0.	282.992	1468.357	1169.239	1.054	
2	0.247	0.14415	0.2115	0.	317.522	1330.487	1013.725	0.973	
3	0.343	0.19094	0.2432	0.	391.313	1197.177	820.554	0.862	
4	0.402	0.11577	0.1051	0.	696.565	1051.624	394.318	1.194	
5	0.309	0.05471	-0.0652	0.	765.013	885.978	207.250	1.510	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7038	0.7145	1.296	1.109		0.	18.980		
2	0.7262	0.7375	1.347	1.123		0.	22.608		
3	0.5245	0.5419	1.303	1.150		0.	30.632		
4	0.8582	0.8676	1.628	1.175		0.	38.621		
5	0.8635	0.8737	1.743	1.200		0.	40.533		

TRAVERSE PRESSURE RATIO = 1.4406 FIXED INSTRUMENTATION PRESSURE RATIO = 1.4420
 TRAVERSE ADIABATIC EFF. = 0.7479 ADIABATIC EFF. = 0.7492
 TRAVERSE POLYTROPIC EFF. = 0.7605 POLYTROPIC EFF. = 0.7619
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 233.80
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98677
 PERCENT DESIGN SPEED = 110 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.96027

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0324	0.6441	0.1533	1.269	1.110
2	0.0374	0.6698	0.1857	1.357	1.136
3	0.0505	0.5786	0.2656	1.319	1.142
4	0.0249	0.8822	0.1009	1.615	1.166
5	0.0425	0.8530	0.1863	1.727	1.198

Table 6. - Listing of Blade Element Performance (continued).

POINT NUMBER 12 READING NUMBER 22 DATE 5/11/1997									
BLADE ELEMENT PERFORMANCE RESULTS									
N.A.S.A. COMPRESSOR OUTPUT DATA									
POS1ITION	REL., INLET	INGRD ANG	INCID ANG	INLET ANG	MACH NO.	SUCT, SURF	VELOCIT Y	AT INLET	VELOCIT Y
POS1ITION	REL., EXIT	REL., DEV.	REL., TURB	REL., TURB	REL., TURB	REL., TURB	REL., TURB	REL., TURB	REL., TURB
1	61.962	3.322	0.222	1.566	1.566	1.469, 2.04	1.666, 0.44	1.469, 2.09	1.666, 0.44
2	59.485	4.155	-0.255	1.4562	1545.667	1351.531	1351.531	0.739	784.808
3	57.502	5.122	-0.252	1.3584	1422.610	1198.116	1198.116	0.732	763.240
4	55.512	5.802	-0.252	1.2069	1286.474	1052.449	1052.449	0.694	722.996
5	56.404	5.804	-1.476	1.0108	1091.280	886.673	886.673	0.589	589.004
1	54.847	6.487	1.0023	1.1712	1084.161	1352.291	1352.291	0.757	714.317
2	48.800	4.510	1.115	1.178	1084.161	1352.291	1352.291	0.757	714.317
3	48.927	7.757	10.935	10.935	1084.161	1352.291	1352.291	0.757	714.317
4	22.803	-0.647	32.710	32.710	0.8129	918.391	1091.173	1123.880	0.995
5	11.291	5.511	45.113	45.113	0.8129	909.713	973.026	1198.673	1.078
1	0.400	0.22567	0.3454	0.	490.234	1469.509	963.137	963.137	0.867
2	0.410	0.22520	0.32772	0.	490.234	1469.509	963.137	963.137	0.867
3	0.536	0.32211	0.3885	0.	516.345	1351.531	815.946	815.946	0.910
4	0.443	0.27113	0.32211	0.	516.345	1351.531	815.946	815.946	0.920
5	0.346	0.27113	0.3209	1.648	1.216	1.216	0.	35.860	0.97964
1	0.413	0.8113	0.8254	1.736	1.211	1.211	0.	35.861	0.97964
2	0.413	0.8113	0.8254	1.736	1.216	1.216	0.	35.860	0.97964
3	0.6314	0.6314	0.8254	1.736	1.211	1.211	0.	46.651	0.98426
4	0.8439	0.8439	0.8254	1.736	1.216	1.216	0.	41.262	0.98426
5	0.8439	0.8439	0.8254	1.736	1.216	1.216	0.	42.627	0.98426
1	0.694	0.694	0.8822	0.2340	1.618	1.214	1.214	1.212	1.212
2	0.689	0.689	0.7883	0.1767	1.732	1.216	1.216	1.201	1.201
3	0.690	0.690	0.7719	0.2411	1.732	1.216	1.216	1.201	1.201
4	0.725	0.725	0.7719	0.2411	1.604	1.201	1.201	1.201	1.201
5	0.725	0.725	0.7880	0.1767	0.8863	0.1535	0.1535	1.212	1.212

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 13 READING NUMBER 23 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.108	3.468	0.428	1.5641	1663.71	1469.465	780.175	0.733	777.770
2	59.575	4.245	-0.165	1.4555	1544.12	1331.491	782.067	0.737	781.948
3	57.435	5.185	-0.525	1.3409	1423.61	1198.080	768.979	0.724	765.177
4	55.088	5.378	-1.192	1.2156	1293.20	1052.418	751.623	0.707	734.509
5	55.940	5.340	-1.940	1.0189	1097.89	886.647	647.385	0.601	599.394
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.144	5.784	7.964	0.9534	1133.249	1453.327	853.763	0.718	663.241
2	47.699	3.409	11.876	0.8831	1036.243	1332.252	898.099	0.765	697.404
3	48.076	11.906	9.359	0.6711	795.896	1212.782	817.814	0.690	531.448
4	24.698	1.248	30.390	0.7377	846.142	1091.706	1067.993	0.931	764.003
5	14.385	8.605	41.556	0.7345	831.652	972.997	1116.513	0.986	784.950
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.436	0.25679	0.3823	0.	535.605	1469.465	917.722	0.853	
2	0.452	0.32569	0.4287	0.	565.838	1331.491	766.414	0.892	
3	0.574	0.37379	0.4493	0.	620.973	1198.080	591.809	0.695	
4	0.503	0.35678	0.3840	0.	740.344	1052.418	351.363	1.040	
5	0.414	0.28328	0.2013	0.	771.677	886.647	201.319	1.310	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		Abs. INLET FLOW ANG.	Abs. EXIT FLOW ANG.		
1	0.7109	0.7328	1.753	1.245		0.	38.923		
2	0.8179	0.8329	1.844	1.234		0.	39.054		
3	0.6626	0.6859	1.669	1.238		0.	49.442		
4	0.8449	0.8584	1.914	1.242		0.	44.099		
5	0.8276	0.8417	1.846	1.232		0.	44.511		
TRAVERSE PRESSURE RATIO	= 1.8077	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.7940					
TRAVERSE ADIABATIC EFF.	= 0.7742		ADIABATIC EFF.	= 0.8100					
TRAVERSE POLYTROPIC EFF.	= 0.7922		POLYTROPIC EFF.	= 0.8249					
FLOW COEFFICIENT L.E.	= 0.980		NOZZLE WEIGHT FLOW	= 234.85					
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98455						
PERCENT DESIGN SPEED	= 110	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.00009						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0529	0.6967	0.2462	1.706	1.237
2	0.0383	0.8078	0.1698	1.817	1.230
3	0.0453	0.7553	0.2237	1.705	1.218
4	0.0283	0.8935	0.1152	1.881	1.221
5	0.0272	0.9152	0.1198	1.881	1.217

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK 1 (ROTOR 2R)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 14 READING NUMBER 24 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.082	3.442	0.402	1.5628	1663.612	1468.997	780.802	0.733	778.395
2	59.549	4.219	-0.191	1.4543	1544.111	1331.068	782.648	0.737	782.529
3	57.559	5.309	-0.401	1.3365	1421.198	1197.699	765.063	0.719	761.280
4	55.577	5.867	-0.703	1.2050	1285.005	1052.083	737.806	0.692	721.007
5	56.414	5.814	-1.466	1.0103	1090.769	886.365	635.715	0.589	588.590
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.022	4.662	9.06n	0.9186	1099.543	1452.865	877.332	0.733	660.802
2	46.977	2.687	12.572	0.8624	1015.828	1331.828	909.693	0.772	693.080
3	46.564	10.394	10.995	0.6394	760.586	1212.396	842.654	0.708	522.597
4	22.593	-0.857	32.984	0.7097	816.082	1091.359	1084.936	0.944	748.661
5	14.017	8.235	42.399	0.6978	794.259	972.687	1101.087	0.967	750.821
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.465	0.27348	0.4015	0.	575.255	1468.997	877.610	0.849	
2	0.470	0.34484	0.4491	0.	589.191	1331.068	742.637	0.886	
3	0.606	0.40026	0.4760	0.	660.460	1197.699	551.936	0.686	
4	0.531	0.37296	0.3992	0.	779.835	1052.083	311.524	1.038	
5	0.448	0.34107	0.2607	0.	785.282	886.365	187.406	1.274	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7066	0.7302	1.825	1.266		0.	41.041		
2	0.8277	0.8426	1.903	1.244		0.	40.368		
3	0.6951	0.7180	1.748	1.249		0.	51.647		
4	0.8588	0.8717	1.981	1.251		0.	46.168		
5	0.8506	0.8634	1.892	1.235		0.	46.285		

TRAVERSE PRESSURE RATIO = 1.8722 FIXED INSTRUMENTATION PRESSURE RATIO = 1.8480
 TRAVERSE ADIABATIC EFF. = 0.7857 ADIABATIC EFF. = 0.8175
 TRAVERSE POLYTROPIC EFF. = 0.8037 POLYTROPIC EFF. = 0.8326
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 234.40
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98166
 PERCENT DESIGN SPEED = 110 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 1.00566

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0559	0.7022	0.2532	1.765	1.251
2	0.0384	0.8172	0.1680	1.878	1.241
3	0.0451	0.7762	0.2164	1.785	1.232
4	0.0264	0.9048	0.1057	1.914	1.225
5	0.0256	0.9198	0.1128	1.909	1.221

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 15 READING NUMBER 25 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN, CMR, LN	INCID ANG SLCT, SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.324	3.684	0.644	1.5584	1660.073	1469.158	772.929	0.726	770.546
2	59.684	4.354	-0.056	1.4516	1542.147	1331.213	778.517	0.733	778.398
3	57.509	5.259	-0.451	1.3375	1422.159	1197.830	766.642	0.721	762.851
4	55.272	5.562	-1.008	1.2111	1290.011	1052.198	746.329	0.701	729.336
5	56.134	5.534	-1.746	1.0146	1094.840	886.462	642.542	0.595	594.911
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.591	4.231	9.732	0.8856	1065.121	1453.023	888.432	0.739	846.472
2	47.220	2.930	12.464	0.8277	980.052	1331.973	904.683	0.764	665.629
3	45.920	9.750	11.589	0.6126	730.955	1212.528	855.559	0.717	508.161
4	23.616	0.166	31.656	0.6832	791.087	1091.478	1062.866	0.918	720.293
5	15.422	9.642	40.712	0.6637	761.026	972.793	1068.519	0.932	715.010
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO	
1	0.492	0.28593	0.4153	0.	607.735	1469.158	845.288	0.839	
2	0.497	0.36536	0.4705	0.	612.664	1331.213	719.310	0.855	
3	0.633	0.42783	0.5039	0.	687.783	1197.830	524.745	0.666	
4	0.552	0.43284	0.4614	0.	776.557	1052.198	314.922	0.988	
5	0.478	0.42809	0.3520	0.	775.550	886.462	197.243	1.202	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	Abs. INLET FLOW ANG.	Abs. EXIT FLOW ANG.			
1	0.7029	0.7279	1.879	1.281	0.	43.231			
2	0.8226	0.8383	1.942	1.254	0.	42.627			
3	0.7149	0.7377	1.813	1.260	0.	53.542			
4	0.8663	0.8789	2.028	1.259	0.	47.153			
5	0.8616	0.8737	1.924	1.239	0.	47.326			

TRAVERSE PRESSURE RATIO = 1.9196 FIXED INSTRUMENTATION PRESSURE RATIO = 1.8920
 TRAVERSE ADIABATIC EFF. = 0.7891 ADIABATIC EFF. = 0.8238
 TRAVERSE POLYTROPIC EFF. = 0.8075 POLYTROPIC EFF. = 0.8389
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 231.88
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.99335
 PERCENT DESIGN SPEED = 110 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 1.00731

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0568	0.7133	0.2550	1.834	1.265
2	0.0390	0.8194	0.1718	1.929	1.252
3	0.0456	0.7839	0.2165	1.839	1.243
4	0.0345	0.8781	0.1391	1.938	1.237
5	0.0228	0.9287	0.1008	1.934	1.223

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 16 READING NUMBER 26 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.468	3.828	0.788	1.5555	1658.860	1470.033	768.648	0.721	766.279
2	59.732	4.402	-0.008	1.4508	1542.316	1332.006	777.495	0.731	777.376
3	57.576	5.326	-0.384	1.3362	1421.929	1198.544	765.099	0.719	761.316
4	55.595	5.885	-0.685	1.2052	1285.616	1052.825	737.813	0.692	721.014
5	56.542	5.942	-1.338	1.0089	1089.751	886.990	633.093	0.586	586.162

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.508	4.148	9.961	0.8399	1018.981	1453.889	896.283	0.739	619.649
2	47.164	2.874	12.567	0.7888	940.086	1332.767	906.927	0.761	639.150
3	45.205	9.035	12.372	0.5972	714.962	1213.251	867.690	0.725	503.404
4	22.609	-0.841	32.986	0.6618	767.938	1092.128	1068.516	0.921	704.411
5	15.342	9.562	41.200	0.6426	737.780	973.373	1058.973	0.922	693.424

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	Axial VFL.RATIO
1	0.528	0.30464	0.4359	0.	646.127	1470.033	807.762	0.809
2	0.530	0.38605	0.4917	0.	643.407	1332.006	689.360	0.822
3	0.649	0.45363	0.5293	0.	706.240	1198.544	507.010	0.661
4	0.573	0.45010	0.4776	0.	798.781	1052.825	293.348	0.977
5	0.499	0.45933	0.3814	0.	783.132	886.990	190.241	1.183

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.6896	0.7168	1.939	1.302	0.	46.198
2	0.8089	0.8264	1.988	1.269	0.	45.190
3	0.7330	0.7555	1.877	1.269	0.	54.519
4	0.8748	0.8869	2.071	1.265	0.	48.592
5	0.8829	0.8933	1.949	1.238	0.	48.477

TRAVERSE PRESSURE RATIO	= 1.9679	FIXED INSTRUMENTATION PRESSURE RATIO	= 1.9440
TRAVERSE ADIABATIC EFF.	= 0.7891	ADIABATIC EFF.	= 0.8299
TRAVERSE POLYTROPIC EFF.	= 0.8081	POLYTROPIC EFF.	= 0.8450
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 233.65
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98120
PERCENT DESIGN SPEED	= 110	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98482

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0575	0.7227	0.2576	1.906	1.280
2	0.0384	0.8276	0.1689	1.983	1.261
3	0.0453	0.7942	0.2121	1.887	1.251
4	0.0362	0.8760	0.1449	1.962	1.243
5	0.0202	0.9376	0.0896	1.952	1.225

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 17 READING NUMBER 27 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	60.982	2.342	-0.698	1.2745	1374.886	1201.420	668.508	0.620	666.447
2	58.077	2.747	-1.663	1.1921	1282.654	1088.614	678.322	0.630	678.219
3	55.750	3.500	-2.210	1.1031	1186.901	979.539	670.253	0.623	666.939
4	53.411	3.701	-2.869	1.0029	1080.573	860.447	653.659	0.607	638.776
5	54.288	3.688	-3.592	0.8439	917.768	724.914	562.849	0.518	521.125
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.603	6.243	6.379	1.0772	1197.674	1188.226	726.698	0.654	693.171
2	51.666	7.376	6.410	0.9463	1059.410	1089.236	706.027	0.631	657.081
3	48.100	11.930	7.651	0.8037	908.826	991.558	684.474	0.605	606.577
4	31.008	7.558	22.402	0.7981	889.042	892.568	879.756	0.790	757.807
5	12.354	6.574	41.934	0.8264	901.607	795.513	1070.893	0.982	857.807
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	Axial Vel. Ratio	
1	0.185	0.10334	0.1604	0.	212.732	1201.420	975.494	1.040	
2	0.241	0.17193	0.2228	0.	258.236	1088.614	831.000	0.969	
3	0.315	0.20768	0.2411	0.	315.528	979.539	676.031	0.909	
4	0.288	0.23473	0.2314	0.	437.083	860.447	455.485	1.186	
5	0.180	=0.02514	-0.1575	0.	607.631	724.914	187.881	1.646	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7775	0.7834	1.207	1.071		0.	17.061		
2	0.7688	0.7758	1.241	1.083		0.	21.455		
3	0.5848	0.5964	1.220	1.100		0.	27.482		
4	0.8869	0.8925	1.425	1.120		0.	29.975		
5	0.9085	0.9138	1.520	1.140		0.	35.312		

TRAVERS E PRESSURE RATIO = 1.3141 FIXED INSTRUMENTATION PRESSURE RATIO = 1.3230
 TRAVERSE ADIABATIC EFF. = 0.8034 ADIABATIC EFF. = 0.8215
 TRAVERSE POLYTROPIC EFF. = 0.8109 POLYTROPIC EFF. = 0.8285
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 215.48
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98734
 PERCENT DESIGN SPEED = 90 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.97333

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0238	0.7115	0.1120	1.208	1.078
2	0.0314	0.6961	0.1514	1.248	1.094
3	0.0382	0.6611	0.1888	1.239	1.095
4	0.0159	0.9125	0.0684	1.422	1.116
5	0.0214	0.9186	0.0936	1.496	1.133

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 18 READING NUMBER 28 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT,SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.085	2.445	-0.595	1.2735	1373.811	1201.683	665.819	0.617	663.767
2	58.121	2.791	-1.619	1.1919	1282.318	1088.852	677.303	0.630	677.200
3	55.852	3.602	-2.198	1.1016	1185.725	979.753	667.853	0.620	664.550
4	53.629	3.919	-2.651	0.9999	1077.683	860.635	648.621	0.602	633.853
5	54.478	3.878	-3.402	0.8414	915.567	725.072	559.047	0.514	517.605

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	55.527	7.167	5.558	0.8867	1019.823	1188.486	675.049	0.587	576.782
2	50.561	6.271	7.560	0.8049	921.228	1089.474	696.700	0.609	585.206
3	44.112	7.942	11.740	0.6649	765.844	991.775	716.596	0.622	549.477
4	30.979	7.529	22.649	0.6624	752.219	892.763	821.782	0.724	641.375
5	15.697	9.917	38.781	0.6598	740.421	795.686	933.073	0.832	694.770

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	Axial Vel.Ratio
1	0.350	0.27226	0.3657	0.	348.405	1201.683	840.080	0.869
2	0.380	0.34435	0.4178	0.	378.019	1088.852	711.455	0.864
3	0.472	0.39104	0.4405	0.	459.081	979.753	532.695	0.827
4	0.431	0.43566	0.4436	0.	507.704	860.635	385.060	1.012
5	0.352	0.32050	0.2299	0.	600.437	725.072	195.249	1.342

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.8182	0.8271	1.422	1.130	0.	31.134
2	0.8981	0.9034	1.458	1.127	0.	32.861
3	0.7632	0.7752	1.448	1.146	0.	39.878
4	0.9139	0.9190	1.541	1.144	0.	38.365
5	0.9048	0.9106	1.563	1.151	0.	40.834

TRAVERSE PRESSURE RATIO	= 1.4815	FIXED INSTRUMENTATION - PRESSURE RATIO	= 1.4940
TRAVERSE ADIABATIC EFF.	= 0.8598	ADIABATIC EFF.	= 0.9037
TRAVERSE POLYTROPIC EFF.	= 0.8674	POLYTROPIC EFF.	= 0.9090
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 216.01
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98178
PERCENT DESIGN SPEED	= 90	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.94526

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0305	0.7719	0.1470	1.424	1.138
2	0.0216	0.8547	0.1014	1.465	1.135
3	0.0290	0.8298	0.1334	1.460	1.138
4	0.0081	0.9613	0.0351	1.536	1.136
5	0.0105	0.9618	0.0467	1.559	1.141

Table 6. - Listing of Blade Element Performance (continued).
NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 19 READING NUMBER 29 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCI.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.151	2.511	-0.529	1.2721	1373.177	1201.886	664.142	0.615	662.095
2	58.186	2.856	-1.554	1.1902	1281.627	1089.036	675.699	0.627	675.596
3	55.850	3.600	-2.110	1.1014	1185.946	979.918	668.003	0.620	664.700
4	53.584	3.874	-2.696	1.0002	1078.496	860.780	649.777	0.603	634.983
5	54.538	3.938	-3.342	0.8405	914.973	725.195	557.914	0.513	516.556
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	55.225	6.865	5.926	0.8606	995.806	1188.687	679.390	0.587	567.512
2	49.895	5.605	8.291	0.7759	891.357	1089.658	704.350	0.613	574.195
3	42.885	6.715	12.965	0.6498	749.362	991.943	731.113	0.634	548.667
4	30.501	7.051	23.083	0.6440	732.275	892.914	820.651	0.722	627.441
5	16.799	11.019	37.739	0.6271	706.223	795.821	902.969	0.802	659.160
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.374	0.30058	0.3971	0.	371.384	1201.886	817.303	0.857	
2	0.411	0.37489	0.4497	0.	407.902	1089.036	681.756	0.850	
3	0.492	0.42780	0.4780	0.	482.353	979.918	509.590	0.825	
4	0.454	0.47237	0.4804	0.	523.308	860.780	369.607	0.988	
5	0.388	0.38925	0.3010	0.	596.825	725.195	198.996	1.276	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS	TOT. TEMP		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8165	0.8262	1.469	1.143		0.	33.201		
2	0.9200	0.9245	1.505	1.135		0.	35.390		
3	0.8192	0.8294	1.504	1.151		0.	41.320		
4	0.9537	0.9566	1.574	1.145		0.	39.829		
5	0.9277	0.9321	1.569	1.148		0.	42.159		

TRAVERSE PRESSURE RATIO = 1.5206 FIXED INSTRUMENTATION PRESSURE RATIO = 1.5240
 TRAVERSE ADIABATIC EFF. = 0.8849 ADIABATIC EFF. = 0.9045
 TRAVERSE POLYTROPIC EFF. = 0.8915 POLYTROPIC EFF. = 0.9100
 FLCW CCEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 214.42
 FLCW CCEFFICIENT T.E. = 0.953 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98757
 PERCENT DESIGN SPEED = 90 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.95339

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0296	0.7934	0.1415	1.472	1.147
2	0.0184	0.8839	0.0855	1.514	1.142
3	0.0255	0.8622	0.1149	1.519	1.147
4	0.0061	0.9722	0.0261	1.566	1.141
5	0.0112	0.9595	0.0502	1.567	1.143

Table 6. - Listing of Blade Element Performance (continued).
NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 20 READING NUMBER 30 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUC. SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.250	2.610	-0.430	1.2700	1371.221	1201.325	661.109	0.612	659.071
2	58.302	2.972	-1.438	1.1882	1279.432	1088.528	672.350	0.624	672.247
3	55.989	3.739	-1.371	1.0993	1183.430	979.461	664.202	0.617	660.918
4	53.809	4.099	-2.371	0.9967	1074.807	860.378	644.173	0.597	629.506
5	54.854	4.254	-3.026	0.8366	910.606	724.856	551.168	0.506	510.310

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.530	6.170	6.720	0.8332	968.249	1188.132	690.561	0.594	561.390
2	49.485	5.195	8.816	0.7538	868.427	1089.149	708.726	0.615	564.157
3	41.718	5.548	14.272	0.6283	725.852	991.480	743.508	0.644	541.385
4	30.503	7.053	23.805	0.6213	708.294	892.497	812.433	0.713	606.879
5	17.004	11.224	37.850	0.5951	670.998	795.449	882.383	0.783	625.634

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO
1	0.400	0.33141	0.4304	0.	400.219	1201.325	787.913	0.852
2	0.433	0.40800	0.4835	0.	428.947	1088.528	660.203	0.839
3	0.518	0.46344	0.5134	0.	508.823	979.461	482.657	0.819
4	0.478	0.50686	0.5137	0.	534.970	860.378	357.527	0.964
5	0.425	0.43802	0.3492	0.	604.124	724.856	191.325	1.226

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.8358	0.8463	1.529	1.154	0.	35.485
2	0.9429	0.9463	1.555	1.143	0.	37.247
3	0.8501	0.8592	1.559	1.159	0.	43.224
4	0.9562	0.9590	1.597	1.150	0.	41.397
5	0.9526	0.9556	1.579	1.147	0.	43.998

TRAVERSE PRESSURE RATIO	= 1.5615	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.5640
TRAVERSE ADIABATIC EFF.	= 0.9031		ADIABATIC EFF.	= 0.9246
TRAVERSE POLYTROPIC EFF.	= 0.9090		POLYTROPIC EFF.	= 0.9292
FLOW COEFFICIENT L.E.	= 0.930		NOZZLE WEIGHT FLOW	= 213.30
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98968	
PERCENT DESIGN SPEED	= 90	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.95832	

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0281	0.8179	0.1318	1.523	1.156
2	0.0158	0.9065	0.0725	1.564	1.150
3	0.0208	0.8947	0.0917	1.569	1.153
4	0.0044	0.9806	0.0187	1.591	1.145
5	0.0104	0.9632	0.0464	1.578	1.145

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 21 READING NUMBER 31 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT,SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.807	3.167	0.127	1.2607	1363.883	1201.241	645.908	0.597	643.917
2	58.863	3.533	-0.877	1.1793	1271.704	1088.452	657.650	0.610	657.550
3	56.634	4.384	-1.326	1.0884	1174.449	979.393	648.168	0.601	644.963
4	54.637	4.927	-1.643	0.9837	1063.250	860.319	624.783	0.578	610.557
5	55.772	5.172	-2.108	0.8247	899.431	724.806	532.572	0.488	493.092
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.108	4.748	8.699	0.7576	889.132	1188.049	716.842	0.611	533.285
2	48.305	4.015	10.558	0.6781	788.627	1089.074	724.842	0.623	524.556
3	40.362	4.192	16.272	0.5903	685.695	991.411	757.149	0.652	522.063
4	31.387	7.937	23.250	0.5618	644.945	892.435	784.936	0.684	547.569
5	16.672	10.892	39.100	0.5317	605.538	795.394	854.337	0.750	563.541
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO	
1	0.476	0.38574	0.4868	0.	477.575	1201.241	710.474	0.828	
2	0.512	0.46497	0.5396	0.	500.216	1088.452	588.858	0.798	
3	0.558	0.52764	0.5746	0.	547.700	979.393	443.710	0.809	
4	0.537	0.57790	0.5798	0.	558.367	860.319	334.069	0.897	
5	0.497	0.55548	0.4613	0.	626.021	724.806	169.373	1.147	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8440	0.8546	1.646	1.182		0.	41.846		
2	0.9194	0.9249	1.651	1.168		0.	43.639		
3	0.8883	0.8959	1.650	1.174		0.	46.373		
4	0.9572	0.9600	1.631	1.157		0.	45.559		
5	0.9325	0.9370	1.620	1.159		0.	47.906		
TRAVERSE PRESSURE RATIO	= 1.6408	FIXED INSTRUMENTATION	PRESSURE RATIO	*	1.6360				
TRAVERSE ADIABATIC EFF.	= 0.9020		ADIABATIC EFF.	*	0.9284				
TRAVERSE POLYTROPIC EFF.	= 0.9086		POLYTROPIC EFF.	*	0.9332				
FLOW CCEFFICIENT L.E.	= 0.980		NOZZLE WEIGHT FLOW	*	209.13				
FLW CCEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	*	0.99068					
PERCENT DESIGN SPEED	= 90	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	*	0.94373					

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0304	0.8317	0.1379	1.626	1.179
2	0.0168	0.9123	0.0756	1.648	1.168
3	0.0168	0.9230	0.0726	1.643	1.165
4	0.0060	0.9746	0.0260	1.624	1.152
5	0.0103	0.9654	0.0458	1.601	1.149

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 22 READING NUMBER 32 DATE 5/11/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR,LN	INCID ANG SUCT,SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.217	3.577	-0.537	1.2544	1358.718	1201.277	634.860	0.586	632.903
2	59.353	4.023	-0.387	1.1712	1265.257	1088.485	645.040	0.597	644.942
3	57.300	5.050	-0.660	1.0784	1165.579	979.422	631.907	0.585	628.782
4	55.322	5.612	-0.958	0.9731	1054.142	860.344	609.117	0.562	595.248
5	56.422	5.822	-1.458	0.8169	891.682	724.828	519.690	0.476	481.166
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.567	4.207	9.651	0.7345	864.604	1188.084	727.464	0.618	525.067
2	48.008	3.718	11.344	0.6561	765.235	1089.106	729.990	0.626	511.949
3	40.865	4.695	16.435	0.5780	671.852	991.440	750.597	0.646	507.694
4	32.487	9.037	22.835	0.5458	626.855	892.462	769.202	0.670	525.948
5	16.455	10.675	39.967	0.5142	586.761	795.418	848.060	0.743	548.591
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO	
1	0.499	0.40490	0.5058	0.	502.156	1201.277	685.928	0.830	
2	0.533	0.48155	0.5550	0.	520.359	1088.485	568.747	0.794	
3	0.568	0.54359	0.5886	0.	552.209	979.422	439.231	0.807	
4	0.550	0.59766	0.5967	0.	557.566	860.344	334.896	0.884	
5	0.516	0.59101	0.4928	0.	633.382	724.828	162.036	1.140	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8519	0.8625	1.692	1.191		0.	43.722		
2	0.9220	0.9276	1.682	1.174		0.	45.467		
3	0.9060	0.9125	1.666	1.174		0.	47.405		
4	0.9872	0.9881	1.634	1.153		0.	46.671		
5	0.9403	0.9443	1.638	1.161		0.	49.103		

TRAVERSE PRESSURE RATIO = 1.6655 FIXED INSTRUMENTATION PRESSURE RATIO = 1.6600
 TRAVERSE ADIABATIC EFF. = 0.9130 ADIABATIC EFF. = 0.9389
 TRAVERSE POLYTROPIC EFF. = 0.9190 POLYTROPIC EFF. = 0.9431
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 205.47
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.99368
 PERCENT DESIGN SPEED = 90 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.94828

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0339	0.8228	0.1521	1.658	1.189
2	0.0205	0.8987	0.0915	1.676	1.177
3	0.0190	0.9151	0.0830	1.661	1.171
4	0.0093	0.9618	0.0407	1.635	1.157
5	0.0114	0.9631	0.0507	1.616	1.153

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 1 READING NUMBER 36 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN, CMBR, LN	INCID ANG SLCT, SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	59.776	1.136	-1.904	0.6983	772.579	667.033	389.800	0.352	388.599
2	56.457	1.127	-3.283	0.6571	725.196	604.403	400.757	0.363	400.696
3	53.610	1.360	-4.350	0.6134	676.770	543.844	402.805	0.365	400.813
4	50.859	1.149	-5.421	0.5640	621.700	477.723	397.858	0.361	388.799
5	51.259	0.659	-6.621	0.4815	532.565	402.475	348.768	0.315	322.914

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.437	5.077	6.339	0.6135	685.296	659.708	423.351	0.379	407.878
2	48.306	4.016	8.151	0.5581	622.499	604.748	437.067	0.392	414.046
3	41.014	4.844	12.596	0.5021	561.074	550.517	461.287	0.413	423.026
4	28.461	5.011	22.398	0.4782	532.245	495.558	528.128	0.475	465.213
5	13.770	7.990	37.490	0.4773	529.516	441.672	605.801	0.546	501.060

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO
1	0.165	0.15487	0.1874	0.	109.763	667.033	549.945	1.050
2	0.206	0.21938	0.2371	0.	139.928	604.403	464.820	1.033
3	0.253	0.26592	0.2683	0.	182.602	543.844	367.916	1.653
4	0.251	0.27498	0.2459	0.	243.375	477.723	252.183	1.197
5	0.152	0.09193	-0.0198	0.	318.882	402.475	122.790	1.552

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.6918	0.8929	1.074	1.023	0.	15.062
2	0.9698	0.9702	1.090	1.026	0.	18.673
3	0.8646	0.8666	1.104	1.033	0.	23.348
4	0.9735	0.9740	1.137	1.038	0.	27.616
5	0.9596	0.9605	1.161	1.046	0.	32.473

TRAVERSE PRESSURE RATIO	= 1.1111	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.1130
TRAVERSE ADIABATIC EFF.	= 0.9378	ADIABATIC EFF.	= 0.9572	
TRAVERSE POLYTROPIC EFF.	= 0.9388	POLYTROPIC EFF.	= 0.9579	
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 143.96	
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ, WEIGHT FLOW	= 0.99412	
PERCENT DESIGN SPEED	= 50	T.E. CHECK WEIGHT FLOW/NOZ, WEIGHT FLOW	= 0.96070	

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0099	0.8505	0.0453	1.076	1.025
2	0.0051	0.9357	0.0229	1.094	1.028
3	0.0093	0.9169	0.0407	1.108	1.032
4	0.0014	0.9911	0.0059	1.137	1.038
5	-0.0083	1.0376	-0.0365	1.159	1.042

Table C-1 - Listings of Blade Element Performance (continued).

POINT NUMBER 2 READING NUMBER 37 DATE 5/12/1967
BLADE ELEMENT PERFORMANCE RESULTS
N.A.S.A. CORRORESSOR OUTLET DATA

Table 6. - Listing of Blade Element Performance (continued).
NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 3 READING NUMBER 38 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN, CMBR, LN	INCID ANG SUCT, SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.807	3.167	0.127	0.6836	756.864	666.612	358.429	0.324	357.324
2	58.696	3.366	-1.044	0.6392	706.967	604.021	367.370	0.332	367.314
3	56.005	3.755	-1.955	0.5940	656.563	543.500	368.352	0.333	366.530
4	53.470	3.760	-2.810	0.5412	599.083	477.422	361.897	0.327	353.657
5	53.667	3.067	-4.213	0.4635	513.680	402.221	319.508	0.288	295.823
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.717	4.357	9.090	0.3605	629.109	659.291	413.534	0.368	360.739
2	47.924	3.634	10.772	0.5083	569.962	604.366	422.803	0.377	363.937
3	41.216	5.046	14.788	0.4532	508.407	550.169	439.142	0.391	382.141
4	28.824	5.374	24.646	0.4236	474.549	495.245	495.123	0.442	413.368
5	14.598	8.218	39.068	0.4190	487.374	441.393	558.512	0.501	440.725
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	Axial Vel. Ratio	
1	0.7246	0.23921	0.2774	0.	159.184	666.612	500.107	1.088	
2	0.280	0.30165	0.3221	0.	181.317	604.021	423.049	1.040	
3	0.326	0.34881	0.3524	0.	215.438	543.500	334.732	1.043	
4	0.330	0.36752	0.3360	0.	267.764	477.422	227.480	1.169	
5	0.248	0.24361	0.1283	0.	326.608	402.221	114.785	1.470	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8986	0.8982	1.111	1.034		0.	22.689		
2	0.9625	0.9632	1.120	1.034		0.	25.395		
3	0.8945	0.8963	1.128	1.039		0.	29.413		
4	0.9565	0.9574	1.148	1.042		0.	32.934		
5	0.9583	0.9592	1.164	1.046		0.	36.541		
TRAVERSE PRESSURE RATIO	= 1.1321	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.1330					
TRAVERSE ADIABATIC EFF.	= 0.9342		ADIABATIC EFF.	= 0.9476					
TRAVERSE POLYTROPIC EFF.	= 0.9354		POLYTROPIC EFF.	= 0.9485					
FLOW COEFFICIENT L.E.	= 0.980		NOZZLE WEIGHT FLOW	= 136.82					
FLOW COEFFICIENT T.E.	= 0.950		L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.96701					
PERCENT DESIGN SPEED	= 50		T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.93838					

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0131	0.8659	0.0588	1.111	1.035
2	0.0079	0.9300	0.0351	1.121	1.036
3	0.0100	0.9273	0.0438	1.129	1.038
4	0.0020	0.9890	0.0084	1.149	1.041
5	-0.0026	1.0106	-0.0116	1.163	1.044

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION											
POSITION	RADIAL	TOT. PRESS	ADITRATIC	LOSS	COEFFICIENT	TOT. PRESS	RATIO	TOT. TEMP	LOSS PARAM	EFFECTIVENESS	RATIO
1	0.0158	0.8524	0.0717	1.120	1.039	1.120	1.039	1.039	0.0001	0.9994	1.165
2	0.0107	0.0132	0.0475	1.129	1.039	1.129	1.039	1.039	0.0032	0.9830	1.153
3	0.0122	0.0168	0.0539	1.129	1.040	1.129	1.040	1.040	0.0122	0.9830	1.042
4	0.0132	0.0132	0.0475	1.129	1.040	1.129	1.040	1.040	0.0032	0.9830	1.045
5	0.0158	0.0158	0.0717	1.120	1.045	1.120	1.045	1.045	0.0001	0.9994	1.165

NASA = TASK I (ROTATOR 2B)

Table 6. - Listing of blade element performance (continued).

POINT NUMBER 4 READINGS NUMBER 39 DATE 5/22 1967

BLADE ELEMENT PERFORMANCE OUTPUT DATA

N.A.S.A. COMPRESSOR OUTPUT DATA

FLOW ANG. INCID ANG. INCID SURF MACH NO. VELOCITY AT INLET MACH NO.

RADIAL REL. EXIT REL. REL. TURB INLET ABS INLET ABS EXIT ABS

RADIAL REL. EXIT REL. REL. TURB INLET REL. EXIT REL. ROTOR SPD EXIT ABS

RADIAL REL. EXIT REL. REL. TURB INLET REL. EXIT REL. ROTOR SPD EXIT ABS

RADIAL REL. EXIT REL. REL. TURB INLET REL. EXIT REL. ROTOR SPD EXIT ABS

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RADIAL REL. EXIT REL. REL. TURB INLET REL. EXIT REL. ROTOR SPD EXIT ABS

RADIAL REL. EXIT REL. REL. TURB INLET REL. EXIT REL. ROTOR SPD EXIT ABS

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 6 READING NUMBER 41 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	63.322	4.682	1.642	0.6727	746.707	666.800	336.081	0.303	335.045
2	60.317	4.987	0.577	0.6280	695.477	604.191	344.444	0.311	344.391
3	57.738	5.488	-0.222	0.5817	643.818	543.653	344.881	0.312	343.176
4	55.236	5.526	-1.044	0.5291	585.755	477.556	339.189	0.306	331.466
5	55.441	4.841	-2.439	0.4521	501.459	402.334	299.314	0.270	297.126
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T,E,	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.105	4.745	10.217	0.5251	592.651	659.477	401.939	0.356	355.483
2	48.192	3.902	12.125	0.4766	536.255	604.536	412.016	0.366	357.481
3	41.900	5.730	15.838	0.4179	470.066	550.324	422.564	0.376	349.610
4	30.474	7.024	24.762	0.3928	440.647	495.384	468.396	0.418	377.667
5	14.825	9.045	40.617	0.3838	428.917	441.517	533.359	0.477	404.062
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	Axial Vel. Ratio	
1	0.297	0.29109	0.3316	0.	185.927	666.800	473.550	1.061	
2	0.328	0.35554	0.3768	0.	204.828	604.191	399.709	1.038	
3	0.382	0.40521	0.4075	0.	236.638	543.653	313.687	1.019	
4	0.376	0.43356	0.3998	0.	273.151	477.556	222.233	1.139	
5	0.308	0.34164	0.2215	0.	334.573	402.334	106.944	1.458	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8687	0.8710	1.130	1.041		0.	27.611		
2	0.9383	0.9395	1.137	1.040		0.	29.812		
3	0.9029	0.9047	1.138	1.042		0.	34.093		
4	0.9596	0.9605	1.153	1.043		0.	35.877		
5	0.9836	0.9840	1.168	1.046		0.	39.626		
TRAVERSE PRESSURE RATIO	= 1.1441	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.1450					
TRAVERSE ADIABATIC EFF.	= 0.9293		ADIABATIC EFF.	= 0.9342					
TRAVERSE POLYTROPIC EFF.	= 0.9306		POLYTROPIC EFF.	= 0.9355					
FLOW COEFFICIENT L,E,	= 0.980		NOZZLE WEIGHT FLOW	= 125.00					
FLOW COEFFICIENT T,E,	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.99832						
PERCENT DESIGN SPEED	= 50	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.96228						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0172	0.8523	0.0779	1.130	1.042
2	0.0119	0.9094	0.0533	1.137	1.041
3	0.0131	0.9148	0.0583	1.140	1.042
4	0.0022	0.9885	0.0096	1.155	1.043
5	-0.0027	1.0104	-0.0120	1.167	1.045

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N,A,S,A, COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 7 READING NUMBER 42 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN, CMBR, LN	INCID ANG SUCT, SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	65.699	7.059	4.019	0.6579	732.048	666.838	302.029	0.271	301.098
2	62.813	7.483	3.073	0.6116	679.294	604.226	310.405	0.279	310.358
3	60.563	8.313	2.603	0.5630	625.034	543.685	308.341	0.278	306.816
4	58.262	8.552	1.982	0.5093	565.209	477.584	302.284	0.272	295.401
5	58.457	7.857	0.577	0.4346	482.752	402.357	266.754	0.240	246.980
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T,E,	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.216	4.856	12.483	0.4697	533.606	659.515	395.577	0.348	319.242
2	49.147	4.857	13.666	0.4251	481.197	604.571	396.196	0.350	314.758
3	41.696	5.526	18.867	0.3569	403.563	550.356	412.924	0.365	301.106
4	30.071	6.621	28.191	0.3470	390.997	495.413	453.080	0.402	336.478
5	14.363	8.583	44.094	0.3415	382.781	441.543	509.685	0.455	361.320
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO	
1	0.387	0.34995	0.3922	0.	232.524	666.838	426.991	1.060	
2	0.410	0.41554	0.4368	0.	240.606	604.226	363.966	1.014	
3	0.492	0.46155	0.4620	0.	282.122	543.685	268.234	0.981	
4	0.454	0.50855	0.4620	0.	300.594	477.584	194.819	1.139	
5	0.384	0.45527	0.3249	0.	349.023	402.357	92.519	1.463	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8047	0.8087	1.155	1.052		0.	36.068		
2	0.8748	0.8774	1.154	1.048		0.	37.395		
3	0.8530	0.8560	1.155	1.049		0.	43.136		
4	0.9061	0.9081	1.165	1.049		0.	41.776		
5	0.9775	0.9780	1.177	1.049		0.	44.008		

TRAVERSE PRESSURE RATIO = 1.1605 FIXED INSTRUMENTATION PRESSURE RATIO = 1.1610
 TRAVERSE ADIABATIC EFF. = 0.8780 ADIABATIC EFF. = 0.8868
 TRAVERSE POLYTROPIC EFF. = 0.8806 POLYTROPIC EFF. = 0.8892
 FLOW COEFFICIENT L.E. = 0.980 NOZZLE WEIGHT FLOW = 110.00
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 1.02394
 PERCENT DESIGN SPEED = 50 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.97914

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0333	0.7803	0.1516	1.154	1.053
2	0.0206	0.8704	0.0943	1.157	1.049
3	0.0232	0.8760	0.1026	1.156	1.048
4	0.0111	0.9517	0.0474	1.167	1.047
5	0.0058	0.9811	0.0255	1.176	1.048

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N,A,S,A, COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 8 READING NUMBER 43 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN, CMBR, LN	INCID ANG SUCT. SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	68.641	10.001	6.961	0.6435	717.463	667.912	262.005	0.235	261.198
2	65.859	10.529	6.119	0.5958	663.219	605.199	271.280	0.244	271.239
3	63.575	11.325	5.615	0.5466	608.696	544.560	271.964	0.244	270.620
4	61.006	11.296	4.726	0.4943	549.914	478.353	271.265	0.244	265.688
5	60.847	10.247	2.967	0.4226	470.492	403.005	242.794	0.218	224.796

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	54.171	5.811	14.470	0.3876	442.633	660.577	398.192	0.349	258.887
2	48.354	4.064	17.505	0.3813	432.811	605.545	402.891	0.355	287.610
3	42.210	6.040	21.365	0.2985	338.833	551.242	409.746	0.361	250.782
4	29.643	6.193	31.363	0.3154	356.421	496.210	446.433	0.395	358.026
5	13.645	7.865	47.202	0.3162	355.705	442.253	499.804	0.444	336.759

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO
1	0.537	0.35919	0.4015	0.	302.005	667.912	358.572	0.991
2	0.490	0.42502	0.4452	0.	282.127	605.199	323.418	1.060
3	0.605	0.47526	0.4736	0.	323.770	544.560	227.472	0.927
4	0.512	0.52880	0.4860	0.	320.923	478.353	175.287	1.162
5	0.431	0.50627	0.3674	0.	360.502	403.005	81.752	1.498

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.7136	0.7198	1.168	1.064	0.	49.396
2	0.8420	0.8455	1.168	1.054	0.	44.449
3	0.8189	0.8228	1.162	1.054	0.	52.240
4	0.8967	0.8990	1.171	1.052	0.	46.175
5	0.9481	0.9494	1.181	1.052	0.	46.950

TRAVERSE PRESSURE RATIO	=	1.1700	FIXED INSTRUMENTATION	PRESSURE RATIO	=	1.1700
TRAVERSE ADIABATIC EFF.	=	0.8367		ADIABATIC EFF.	=	0.8738
TRAVERSE POLYTROPIC EFF.	=	0.8403		POLYTROPIC EFF.	=	0.8767
FLOW COEFFICIENT L.E.	=	0.980		NOZZLE WEIGHT FLOW	=	99.00
FLOW COEFFICIENT T.E.	=	0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW		=	1.01236
PERCENT DESIGN SPEED	=	50	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW		=	0.95739

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0508	0.7131	0.2364	1.165	1.062
2	0.0267	0.8534	0.1201	1.168	1.053
3	0.0273	0.8684	0.1218	1.165	1.051
4	0.0102	0.9589	0.0434	1.172	1.048
5	-0.0049	1.0152	-0.0215	1.182	1.048

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK 1 (ROTOR 28)

N.A.S.A. COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 9 READING NUMBER 44 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID. ANG MN, CMBR. LN	INCID. ANG SUCT, SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	60.119	1.479	-1.561	0.9850	1076.741	932.883	537.681	0.492	536.023
2	57.246	1.916	-2.494	0.9207	1005.142	845.291	543.869	0.498	543.786
3	54.647	2.397	-3.313	0.8568	934.112	760.596	542.272	0.497	539.591
4	52.070	2.360	-4.210	0.7832	854.565	668.123	532.816	0.488	520.685
5	52.457	1.857	-5.423	0.6671	731.534	562.884	467.229	0.426	432.594
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T,E,	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	55.003	6.645	5.114	0.8502	949.819	922.638	564.606	0.505	544.294
2	50.847	6.557	6.480	0.7668	857.317	845.774	570.771	0.511	541.301
3	42.038	5.868	12.609	0.6367	715.908	769.929	606.374	0.539	531.307
4	29.574	6.124	22.496	0.6518	726.199	693.065	716.735	0.643	628.020
5	15.001	9.221	37.456	0.6496	717.353	617.703	820.127	0.743	675.259
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO	
1	0.167	0.13920	0.1856	0.	145.173	932.883	777.465	1.015	
2	0.207	0.19918	0.2325	0.	180.971	845.291	664.803	0.995	
3	0.329	0.23462	0.2511	0.	290.908	760.596	479.021	0.985	
4	0.258	0.26724	0.2505	0.	336.680	668.123	356.385	1.206	
5	0.165	0.11422	0.0048	0.	436.755	562.884	180.947	1.561	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		Abs. INLET FLOW ANG.	Abs. EXIT FLOW ANG.		
1	0.7526	0.7569	1.130	1.047		0.	14.934		
2	0.8191	0.8228	1.155	1.051		0.	18.486		
3	0.6608	0.6686	1.178	1.073		0.	28.702		
4	0.9127	0.9157	1.272	1.078		0.	28.196		
5	0.9592	0.9608	1.324	1.087		0.	32.895		
TRAVERSE PRESSURE RATIO	= 1.2071	FIXED INSTRUMENTATION PRESSURE RATIO	= 1.2110						
TRAVERSE ADIABATIC EFF.	= 0.8348	ADIABATIC EFF.	= 0.8620						
TRAVERSE POLYTROPIC EFF.	= 0.8392	POLYTROPIC EFF.	= 0.8657						
FLOW COEFFICIENT L,E.	= 0.988	NOZZLE WEIGHT FLOW	= 185.78						
FLOW COEFFICIENT T,E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.99035						
PERCENT DESIGN SPEED	= 70	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.96096						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0211	0.7137	0.1003	1.130	1.050
2	0.0167	0.8122	0.0789	1.162	1.054
3	0.0317	0.7553	0.1407	1.190	1.068
4	0.0087	0.9504	0.0369	1.273	1.075
5	0.0013	0.9946	0.0058	1.320	1.083

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK 1 (ROTOR 28)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 10 READING NUMBER 45 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.045	2.405	-0.635	0.9739	1067.357	933.260	517.954	0.473	516.358
2	58.214	2.884	-1.526	0.9103	994.875	845.633	524.101	0.480	524.022
3	55.693	3.443	-2.267	0.8445	922.614	760.903	521.769	0.478	519.189
4	53.212	3.502	-3.068	0.7710	841.623	668.393	511.450	0.469	499.805
5	53.759	3.159	-4.121	0.6544	718.220	563.111	445.809	0.406	412.761

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T,E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.859	4.499	8.186	0.7510	850.966	923.011	570.045	0.503	513.332
2	49.023	4.733	9.192	0.6804	768.361	846.116	569.789	0.505	503.851
3	40.960	4.790	14.733	0.5943	672.229	770.240	605.683	0.535	507.248
4	30.348	6.898	22.864	0.5615	630.583	693.345	662.585	0.590	541.146
5	15.509	9.729	38.249	0.5482	612.192	617.952	747.969	0.670	574.946

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO
1	0.287	0.26931	0.3318	0.	245.262	933.260	677.749	0.994
2	0.317	0.33737	0.3811	0.	266.035	845.633	580.081	0.962
3	0.380	0.39326	0.4171	0.	329.917	760.983	440.323	0.977
4	0.373	0.42554	0.4123	0.	376.517	668.393	316.828	1.083
5	0.304	0.33386	0.2317	0.	458.403	563.111	159.549	1.393

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.8752	0.8792	1.250	1.075	0.	25.538
2	0.9389	0.9409	1.260	1.073	0.	27.834
3	0.8773	0.8816	1.283	1.084	0.	33.040
4	0.9501	0.9520	1.312	1.085	0.	34.829
5	0.9409	0.9433	1.340	1.093	0.	38.565

TRAVERSE PRESSURE RATIO	= 1.2857	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.2820
TRAVERSE ADIABATIC EFF.	= 0.9161	ADIABATIC EFF.	= 0.9249	
TRAVERSE POLYTROPIC EFF.	= 0.9190	POLYTROPIC EFF.	= 0.9276	
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 180.28	
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.99040	
PERCENT DESIGN SPEED	= 70	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.96390	

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0171	0.8547	0.0773	1.247	1.076
2	0.0112	0.9130	0.0510	1.262	1.075
3	0.0146	0.9081	0.0638	1.278	1.080
4	0.0068	0.9650	0.0291	1.308	1.083
5	0.0047	0.9820	0.0208	1.332	1.087

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 11 READING NUMBER 46 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG., MN, CMBR. LN	INCID ANG SUCT, SURF	INCID ANG	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX, VELOCITY
1	61.689	3.049	0.009	0.9672	1061.631	933.997	504.689	0.460	503.133
2	58.879	3.549	-0.861	0.9021	988.621	846.301	511.026	0.466	510.948
3	56.515	4.265	-1.445	0.8349	914.420	761.504	506.236	0.462	503.733
4	54.127	4.417	-2.153	0.7596	832.160	668.921	495.011	0.452	483.740
5	54.681	4.081	-3.199	0.6447	709.637	563.556	431.264	0.392	399.295

RADIAL POSITION	REL. EXIT FLOW ANG., ANG. T.E.	REL. DEV. ANG., T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX, VELOCITY
1	53.110	4.750	8.579	0.7185	818.502	923.740	561.147	0.493	490.895
2	48.712	4.422	10.167	0.6476	735.726	846.784	567.538	0.500	485.458
3	41.292	5.122	15.223	0.5710	648.637	770.848	596.279	0.525	486.979
4	30.028	6.578	24.099	0.5303	598.880	693.893	653.119	0.578	515.594
5	15.441	9.661	39.240	0.5162	579.184	618.440	729.398	0.650	544.115

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO
1	0.322	0.30956	0.3748	0.	269.685	933.997	654.055	0.976
2	0.355	0.37866	0.4234	0.	293.965	846.301	552.819	0.950
3	0.405	0.43470	0.4580	0.	343.146	761.504	427.703	0.967
4	0.411	0.46963	0.4545	0.	395.878	668.921	298.014	1.066
5	0.345	0.39497	0.2903	0.	468.143	563.556	150.298	1.363

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.8746	0.8789	1.281	1.084	0.	28.783
2	0.9278	0.9304	1.291	1.082	0.	31.197
3	0.8880	0.8921	1.305	1.089	0.	35.170
4	0.9432	0.9455	1.329	1.090	0.	37.517
5	0.9466	0.9488	1.347	1.094	0.	40.708

TRAVERSE PRESSURE RATIO	= 1.3079	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.3050
TRAVERSE ADIABATIC EFF.	= 0.9146	ADIABATIC EFF.	= 0.9319	
TRAVERSE POLYTROPIC EFF.	= 0.9178	POLYTROPIC EFF.	= 0.9344	
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 176.74	
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.98445	
PERCENT DESIGN SPEED	= 70	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.95416	

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0160	0.8767	0.0724	1.282	1.084
2	0.0110	0.9225	0.0500	1.293	1.083
3	0.0132	0.9217	0.0580	1.299	1.084
4	0.0069	0.9665	0.0294	1.321	1.086
5	0.0065	0.9764	0.0287	1.340	1.089

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 12 READING NUMBER 47 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.089	3.449	0.499	0.9621	1057.329	933.700	496.134	0.451	494.605
2	59.397	4.067	-0.343	0.8969	982.976	846.032	500.472	0.457	580.396
3	57.157	4.907	-0.803	0.8278	907.422	761.262	493.857	0.451	491.415
4	55.038	5.328	-1.242	0.7504	822.254	668.708	478.467	0.437	467.573
5	55.639	5.039	-2.241	0.6358	700.334	563.377	416.022	0.378	385.183
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.224	4.864	8.865	0.6991	798.344	923.446	556.895	0.488	477.544
2	48.549	4.259	10.848	0.6309	717.632	846.515	566.520	0.498	475.046
3	41.417	5.247	15.740	0.5535	629.993	770.603	590.681	0.519	472.079
4	30.427	6.977	24.611	0.5189	586.443	693.672	644.479	0.570	502.867
5	15.522	9.742	40.118	0.4998	561.219	618.244	718.471	0.640	527.044
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.343	0.33041	0.3966	0.	284.550	933.700	638.896	0.966	
2	0.375	0.39826	0.4430	0.	308.640	846.032	537.875	0.949	
3	0.425	0.45206	0.4746	0.	354.166	761.262	416.437	0.961	
4	0.420	0.48020	0.4631	0.	398.328	668.708	295.344	1.075	
5	0.363	0.42810	0.3118	0.	471.868	563.377	146.376	1.368	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8863	0.8905	1.298	1.087		0.	30.789		
2	0.9317	0.9342	1.307	1.086		0.	33.012		
3	0.8797	0.8842	1.314	1.082		0.	36.878		
4	0.9318	0.9346	1.332	1.092		0.	38.383		
5	0.9560	0.9578	1.351	1.094		0.	41.838		
TRAVERSE PRESSURE RATIO	= 1.3182	FIXED INSTRUMENTATION PRESSURE RATIO	= 1.3170						
TRAVERSE ADIABATIC EFF.	= 0.9158	ADIABATIC EFF.	= 0.9383						
TRAVERSE POLYTROPIC EFF.	= 0.9190	POLYTROPIC EFF.	= 0.9407						
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 174.16						
FLOW COEFFICIENT T.E.	= 0.959	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.97908						
PERCENT DESIGN SPEED	= 70	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.95101						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0164	0.8800	0.0745	1.300	1.088
2	0.0099	0.9340	0.0447	1.310	1.086
3	0.0123	0.9297	0.0541	1.311	1.087
4	0.0056	0.9736	0.0241	1.329	1.087
5	0.0054	0.9810	0.0239	1.346	1.090

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N,A,S,A, COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 13 READING NUMBER 48 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	63.373	4.733	1.693	0.9500	1045.378	933.925	469.680	0.427	468.232
2	60.688	5.358	0.948	0.8842	970.527	846.236	475.193	0.433	475.121
3	58.534	6.284	0.574	0.8150	893.927	761.446	468.302	0.427	465.987
4	56.282	6.572	0.002	0.7378	809.966	668.869	456.792	0.416	446.392
5	56.873	6.273	-1.007	0.6257	689.417	563.513	397.176	0.360	367.734

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG, T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.925	4.563	10.448	0.6637	761.080	923.669	558.264	0.487	458.423
2	48.296	4.006	12.392	0.5910	674.812	846.719	564.938	0.495	448.937
3	42.450	6.280	16.085	0.5190	592.296	770.789	573.692	0.503	436.712
4	31.022	7.572	25.260	0.4777	541.256	693.839	624.029	0.551	461.294
5	14.899	9.119	41.973	0.4645	522.838	618.393	702.668	0.624	492.380

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	Axial VEL. RATIO
1	0.383	0.36238	0.4294	0.	316.986	933.925	606.683	0.979
2	0.423	0.43163	0.4757	0.	342.922	846.236	503.797	0.945
3	0.464	0.48457	0.5054	0.	371.323	761.446	399.466	0.937
4	0.473	0.52797	0.5079	0.	416.427	668.869	277.412	1.033
5	0.415	0.48998	0.3770	0.	487.386	563.513	131.006	1.339

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.8742	0.8793	1.334	1.098	0.	34.663
2	0.9145	0.9180	1.337	1.095	0.	37.374
3	0.8628	0.8682	1.327	1.098	0.	40.374
4	0.9472	0.9494	1.342	1.093	0.	42.074
5	0.9594	0.9611	1.365	1.097	0.	44.708

TRAVERSE PRESSURE RATIO	= 1.3398	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.3390
TRAVERSE ADIABATIC EFF.	= 0.9078	ADIABATIC EFF.	= 0.9371	
TRAVERSE POLYTROPIC EFF.	= 0.9115	POLYTROPIC EFF.	= 0.9397	
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 165.43	
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.99068	
PERCENT DESIGN SPEED	= 70	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.95588	

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0189	0.8763	0.0855	1.333	1.098
2	0.0109	0.9341	0.0487	1.337	1.093
3	0.0139	0.9247	0.0622	1.327	1.091
4	0.0047	0.9790	0.0203	1.344	1.090
5	0.0040	0.9866	0.0177	1.358	1.093

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK 1 (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 14 READING NUMBER 49 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG. MN.CMBR.LN	INCID ANG SUCT.SURF	INCID ANG MACH NO.	INLET REL VELOCITY	INLET REL AT INLET	ROTOR SPD VELOCITY	INLET ABS MACH NO.	INLET ABS MACH NO.	INLET AX. VELOCITY
1	64.782	6.142	3.102	0.9367	1033.663	934.619	441.528	0.400	440.167
2	62.307	6.977	2.567	0.8687	956.456	846.864	444.555	0.404	444.487
3	60.465	8.215	2.505	0.7966	876.879	762.011	433.885	0.394	431.740
4	58.349	8.639	2.069	0.7185	791.411	669.366	422.232	0.383	412.618
5	58.710	8.110	0.830	0.6105	674.577	563.931	370.184	0.335	342.743
RADIAL POSITION	REL. EXIT FLOW ANG. ANG. T.E.	REL. DEV. ANGLE	REL. TURN	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.004	3.644	12.778	0.6223	716.770	924.355	570.009	0.495	440.842
2	48.603	4.313	13.704	0.5556	637.273	847.348	540.344	0.489	421.406
3	42.583	6.413	17.882	0.4551	521.656	771.362	568.311	0.496	383.810
4	30.113	6.663	28.236	0.4537	515.953	694.354	625.192	0.550	443.821
5	14.294	8.514	44.416	0.4439	501.076	618.852	696.316	0.617	473.119
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.434	0.38006	0.4468	0.	360.026	934.619	564.329	1.002	
2	0.463	0.44324	0.4860	0.	369.309	846.864	478.038	0.948	
3	0.551	0.48966	0.5082	0.	418.644	762.011	382.718	0.889	
4	0.500	0.54810	0.5158	0.	436.943	669.366	257.412	1.076	
5	0.438	0.52556	0.4051	0.	498.308	563.931	120.544	1.380	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8633	0.8692	1.365	1.108		0.	39.238		
2	0.8786	0.8837	1.349	1.102		0.	41.230		
3	0.8259	0.8329	1.333	1.104		0.	47.486		
4	0.9215	0.9249	1.356	1.099		0.	44.553		
5	0.9631	0.9847	1.376	1.099		0.	46.485		
TRAVERSE PRESSURE RATIO	# 1.3560	FIXED INSTRUMENTATION	PRESSURE RATIO	# 1.3530					
TRAVERSE ADIABATIC EFF.	# 0.8866		ADIABATIC EFF.	# 0.9024					
TRAVERSE POLYTROPIC EFF.	# 0.8914		POLYTROPIC EFF.	# 0.9065					
FLOW COEFFICIENT L.E.	# 0.980		NOZZLE WEIGHT FLOW	# 157.92					
FLOW COEFFICIENT T.E.	# 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	# 0.97667						
PERCENT DESIGN SPEED	= 70	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	# 0.94688						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0296	0.8309	0.1309	1.356	1.109
2	0.0206	0.8849	0.0931	1.346	1.100
3	0.0227	0.8878	0.1019	1.339	1.098
4	0.0107	0.9567	0.0457	1.356	1.095
5	0.0058	0.9819	0.0257	1.370	1.096

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 15 READING NUMBER 50 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.LN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	66.687	8.047	5.007	0.9210	1018.211	934.628	404.010	0.365	462.765
2	64.292	8.962	4.552	0.8515	939.935	846.872	407.782	0.369	467.720
3	62.332	10.082	4.372	0.7810	861.324	762.018	401.505	0.364	399.520
4	59.712	10.002	3.432	0.7074	779.821	669.372	400.077	0.363	390.967
5	59.829	9.229	1.949	0.6022	665.886	563.937	354.090	0.320	327.842

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	53.500	5.140	13.187	0.5664	655.632	924.364	557.490	0.482	389.644
2	49.339	5.049	14.953	0.5178	595.676	847.356	554.138	0.482	388.125
3	43.326	7.156	19.007	0.4139	475.583	771.369	564.031	0.491	345.719
4	30.021	6.571	29.691	0.4325	492.583	694.361	620.040	0.544	424.111
5	13.990	8.210	45.838	0.4291	485.061	618.858	690.546	0.611	458.579

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO
1	0.499	0.37260	0.4381	0.	397.782	934.628	526.582	0.967
2	0.507	0.43793	0.4790	0.	395.495	846.872	451.860	0.952
3	0.605	0.48808	0.5046	0.	445.287	762.018	326.082	0.865
4	0.526	0.55469	0.5277	0.	449.297	669.372	245.064	1.085
5	0.457	0.55966	0.4256	0.	504.603	563.937	114.255	1.399

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.7794	0.7888	1.360	1.118	0.	45.592
2	0.8390	0.8458	1.350	1.107	0.	45.539
3	0.7936	0.8019	1.337	1.109	0.	52.174
4	0.9045	0.9986	1.363	1.102	0.	46.652
5	0.9545	0.9565	1.382	1.102	0.	47.736

TRAVERSE PRESSURE RATIO	*	1.3582	FIXED INSTRUMENTATION	PRESSURE RATIO	*	1.3540
TRAVERSE ADIABATIC EFF.	*	0.8478	ADIABATIC EFF.	*	0.8710	
TRAVERSE POLYTROPIC EFF.	*	0.8543	POLYTROPIC EFF.	*	0.8764	
FLOW COEFFICIENT L.E.	*	0.980	NOZZLE WEIGHT FLOW	*	151.33	
FLOW COEFFICIENT T.E.	*	0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	*	0.95936	
PERCENT DESIGN SPEED	=	70	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	*	0.91373	

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0430	0.7644	0.1971	1.351	1.117
2	0.0293	0.8458	0.1344	1.350	1.106
3	0.0304	0.8576	0.1379	1.341	1.102
4	0.0157	0.9391	0.0670	1.356	1.097
5	0.0049	0.9854	0.0215	1.375	1.097

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2R)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 17 READING NUMBER 52 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR,LN	INCID ANG SLCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.948	4.308	1.268	1.2413	1349.684	1201.253	615.335	0.566	613.438
2	59.889	4.559	0.149	1.1623	1258.306	1088.463	631.334	0.583	631.238
3	57.887	5.637	=0.073	1.0698	1157.945	979.403	617.744	0.571	614.689
4	55.812	6.102	=0.468	0.9672	1047.766	860.327	598.039	0.552	584.422
5	56.854	6.254	=1.026	0.8117	886.964	724.813	511.225	0.468	473.328
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DFV, ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.251	3.891	10.697	0.7092	840.523	1188.061	735.002	0.620	514.095
2	47.540	3.250	12.350	0.6451	756.881	1089.085	736.710	0.628	510.948
3	41.097	4.927	16.790	0.5735	669.616	991.421	747.803	0.640	504.229
4	31.663	8.213	24.149	0.5482	633.051	892.444	779.293	0.675	535.903
5	17.052	11.272	39.802	0.5121	586.050	795.402	842.351	0.736	546.295
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.519	0.41791	0.5178	0.	524.064	1201.253	663.997	0.838	
2	0.540	0.49660	0.5686	0.	530.710	1088.463	558.374	0.809	
3	0.567	0.56191	0.6049	0.	551.602	979.403	439.819	0.820	
4	0.543	0.62211	0.6186	0.	561.940	860.327	330.504	0.917	
5	0.512	0.62770	0.5261	0.	627.836	724.813	167.566	1.154	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.8262	0.8390	1.723	1.204		0.	45.550		
2	0.8831	0.8916	1.719	1.188		0.	46.087		
3	0.8778	0.8864	1.685	1.183		0.	47.569		
4	0.9296	0.9346	1.668	1.170		0.	46.359		
5	0.9333	0.9379	1.654	1.166		0.	48.973		
TRAVERSE PRESSURE RATIO	= 1.6911	FIXED INSTRUMENTATION PRESSURE RATIO	= 1.6760						
TRAVERSE ADIABATIC EFF.	= 0.8820	ADIABATIC EFF.	= 0.9055						
TRAVERSE POLYTROPIC FFF.	= 0.8904	POLYTROPIC FFF.	= 0.9122						
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 200.01						
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.00679						
PERCENT DESIGN SPEED	= 90	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.97704						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0380	0.8120	0.1690	1.684	1.198
2	0.0202	0.9040	0.0894	1.702	1.182
3	0.0189	0.9174	0.0827	1.675	1.173
4	0.0082	0.9671	0.0356	1.645	1.158
5	0.0065	0.9792	0.0291	1.634	1.154

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 18 READING NUMBER 53 DATE 5/12/1967

RADIAL POSITION	REL. INLET FLOW ANG. MN.CMBR.LN	INCID ANG SUCL.SURF	INCID ANG SUCL.SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.424	3.789	0.749	1.4003	1507.064	1335.034	699.233	0.650	697.078
2	59.440	4.110	-0.300	1.3106	1404.865	1209.683	714.362	0.666	714.253
3	57.415	5.166	-0.544	1.2060	1293.661	1088.476	699.127	0.652	695.670
4	55.550	5.840	-0.730	1.0866	1168.203	956.140	671.189	0.624	655.907
5	56.295	5.695	-1.585	0.9139	992.822	805.534	580.355	0.534	537.333

RADIAL POSITION	REL. EXIT FLOW ANG. ANG. T.E.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	51.823	3.463	10.606	0.7449	897.856	1320.373	829.098	0.688	554.440
2	46.660	2.370	12.781	0.7035	834.535	1210.374	831.990	0.701	572.756
3	40.920	4.750	16.496	0.5895	698.516	1101.833	833.369	0.703	527.402
4	29.814	6.364	25.736	0.5985	696.443	991.834	886.429	0.762	600.863
5	18.679	12.899	37.616	0.5487	633.388	883.984	912.567	0.790	585.307

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO
1	0.553	0.39153	0.5094	0.	615.221	1335.034	705.152	0.795
2	0.550	0.48168	0.5793	0.	603.435	1209.683	606.939	0.802
3	0.612	0.54998	0.6073	0.	644.660	1088.476	457.173	0.758
4	0.556	0.59990	0.6087	0.	647.517	956.140	344.317	0.916
5	0.531	0.61681	0.5259	0.	686.113	805.534	197.871	1.089

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.7621	0.7827	1.917	1.268	0.	47.975
2	0.8733	0.8845	1.930	1.237	0.	46.494
3	0.8321	0.8463	1.876	1.237	0.	50.713
4	0.9182	0.9251	1.875	1.214	0.	47.140
5	0.8952	0.9034	1.794	1.203	0.	49.533

TRAVERSE PRESSURE RATIO = 1.8843 FIXED INSTRUMENTATION PRESSURE RATIO = 1.8640
 TRAVERSE ADIABATIC EFF. = 0.8464 ADIABATIC EFF. = 0.8821
 TRAVERSE POLYTROPIC EFF. = 0.8594 POLYTROPIC EFF. = 0.8919
 FLOW COEFFICIENT L.E. = 0.930 NOZZLE WEIGHT FLOW = 221.05
 FLOW COEFFICIENT T.E. = 0.950 L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98846
 PERCENT DESIGN SPEED = 100 T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.98511

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0472	0.7805	0.2084	1.866	1.250
2	0.0243	0.8927	0.1056	1.912	1.228
3	0.0288	0.8812	0.1256	1.863	1.221
4	0.0064	0.9762	0.0272	1.861	1.199
5	0.0141	0.9539	0.0637	1.763	1.184

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

POINT NUMBER 9 READING NUMBER 124 DATE 5/31/1967
BLADE ELEMENT PERFORMANCE RESULTS
N.A.S.C. COMPREHENSIVE OUTPUT DATA

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 6 READING NUMBER 125 DATE 5/31/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN, CMBR.LN	INCID ANG SUCT. SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.173	3.533	0.493	1.4019	1509.674	1334.192	706.434	0.656	704.256
2	59.182	3.852	-0.558	1.3125	1407.745	1208.920	721.289	0.673	721.180
3	56.885	4.635	-1.075	1.2118	1300.661	1087.790	713.045	0.664	709.519
4	54.812	5.102	-1.468	1.0989	1178.301	955.537	689.452	0.643	673.754
5	56.197	5.597	-1.683	0.9149	993.454	805.026	582.138	0.536	538.985
RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T,E,	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	51.712	3.352	10.460	0.7710	930.203	1319.540	825.473	0.684	575.821
2	46.086	1.796	13.096	0.7284	862.948	1209.610	839.019	0.708	598.512
3	40.062	3.892	16.823	0.6026	712.378	1101.138	843.245	0.713	584.780
4	29.308	5.858	25.504	0.5999	696.092	991.208	891.841	0.769	683.541
5	17.657	11.877	38.539	0.5547	638.094	883.427	924.184	0.803	592.945
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO	
1	0.527	0.39479	0.5128	0.	590.097	1334.192	729.443	0.818	
2	0.527	0.47694	0.5660	0.	587.970	1208.920	621.640	0.830	
3	0.603	0.53981	0.5986	0.	643.010	1087.790	458.128	0.768	
4	0.561	0.58805	0.5998	0.	652.401	955.537	338.807	0.896	
5	0.529	0.56101	0.4731	0.	694.679	805.026	188.748	1.100	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7638	0.7842	1.910	1.266		0.	45.702		
2	0.8865	0.8965	1.927	1.233		0.	44.491		
3	0.8521	0.8645	1.868	1.230		0.	49.728		
4	0.9249	0.9812	1.865	1.211		0.	47.228		
5	0.8852	0.8940	1.765	1.199		0.	49.517		
TRAVERSE PRESSURE RATIO				FIXED INSTRUMENTATION	PRESSURE RATIO	=	1.8560		
TRAVERSE ADIABATIC EFF.					ADIABATIC EFF.	=	0.8810		
TRAVERSE POLYTROPIC EFF.					POLYTROPIC EFF.	=	0.8909		
FLOW COEFFICIENT L.E.					NOZZLE WEIGHT FLOW	=	219.72		
FLOW COEFFICIENT T,E.				L,E, CHECK WEIGHT FLOW/NOZ.	WEIGHT FLOW	=	0.99850		
PERCENT DESIGN SPEED				T,E, CHECK WEIGHT FLOW/NOZ.	WEIGHT FLOW	=	1.00862		

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0473	0.7799	0.2080	1.860	1.249
2	0.0259	0.8866	0.1117	1.909	1.229
3	0.0305	0.8754	0.1315	1.862	1.222
4	0.0096	0.9640	0.0408	1.857	1.201
5	0.0162	0.9476	0.0728	1.766	1.186

Table 6. - Listing of Blade Element Performance (continued).

NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA

BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 7 READING NUMBER 126 DATE 5/31/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN, CHBR, LN	INCID ANG SUCT, SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.277	2.637	-0.403	1.4230	1521.939	1333.714	733.148	0.685	730.888
2	58.512	3.189	-1.228	1.3277	1417.225	1208.486	740.329	0.694	740.216
3	56.331	4.081	-1.629	1.2268	1308.568	1087.400	727.951	0.682	724.351
4	54.252	4.549	-2.028	1.1081	1186.364	955.194	703.607	0.657	687.587
5	53.176	4.576	-2.704	0.9300	1006.573	804.737	604.638	0.559	559.817

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	56.827	8.467	4.450	1.1980	1336.278	1319.067	759.609	0.682	730.640
2	53.405	9.115	5.107	1.0665	1197.942	1209.177	755.806	0.673	714.143
3	47.940	11.770	8.391	0.8996	1019.786	1100.743	765.366	0.675	682.723
4	30.536	7.084	23.716	0.8961	994.948	990.853	987.673	0.890	852.209
5	14.870	9.090	40.306	0.8758	956.225	883.110	1127.778	1.033	900.635

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CHI	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL. RATIO
1	0.170	0.10778	0.1772	0.	201.394	1333.714	1117.673	1.000
2	0.213	0.17118	0.2342	0.	247.393	1208.486	961.783	0.965
3	0.301	0.21069	0.2560	0.	344.085	1087.400	786.638	0.943
4	0.274	0.18134	0.1784	0.	488.149	955.194	502.704	1.239
5	0.204	-0.00516	-0.1369	0.	643.975	804.737	239.135	1.609

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.7516	0.7592	1.242	1.085	0.	15.410
2	0.7593	0.7680	1.298	1.102	0.	19.107
3	0.6276	0.6415	1.310	1.128	0.	26.748
4	0.8542	0.8625	1.514	1.148	0.	29.884
5	0.8640	0.8725	1.586	1.163	0.	35.566

TRAVERSE PRESSURE RATIO	= 1.3778	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.3690
TRAVERSE ADIABATIC EFF.	= 0.7813	ADIABATIC EFF.	= 0.7536	
TRAVERSE POLYTROPIC EFF.	= 0.7910	POLYTROPIC EFF.	= 0.7643	
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 223.70	
FLOW COEFFICIENT T.E.	= 0.990	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.00051	
PERCENT DESIGN SPEED	= 100	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.01039	

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0276	0.6547	0.1375	1.225	1.091
2	0.0360	0.6583	0.1805	1.290	1.115
3	0.0424	0.6518	0.2087	1.299	1.119
4	0.0243	0.8747	0.1042	1.514	1.144
5	0.0401	0.8503	0.1768	1.566	1.161

Table 6. - Listing of Blade Element Performance (continued).
NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 13 READING NUMBER 156 DATE 6/14/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.IN	INCID ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VFLCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.256	2.616	-0.424	1.4143	1515.383	1327.701	730.475	0.682	728.224
2	58.494	3.164	-1.246	1.3213	1411.103	1203.038	737.502	0.691	737.390
3	56.542	4.292	-1.418	1.2165	1299.476	1082.498	718.913	0.673	715.358
4	54.425	4.715	-1.855	1.1012	1178.388	950.888	695.995	0.650	680.148
5	54.624	4.024	-3.256	0.9345	1009.555	801.110	614.349	0.569	568.807

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DEV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VFLCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	56.591	8.231	4.665	1.1584	1292.052	1313.120	750.494	0.673	710.896
2	53.118	8.828	5.376	1.0333	1160.283	1203.725	748.954	0.667	696.354
3	48.056	11.886	8.486	0.8708	988.316	1095.781	753.297	0.664	660.189
4	28.764	5.334	25.641	0.8891	984.769	986.386	1006.309	0.909	858.137
5	13.239	7.459	41.385	0.8710	949.351	879.129	1140.939	1.047	900.230

RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO
1	0.204	0.11348	0.1843	0.	235.366	1327.701	1077.755	0.976
2	0.243	0.17508	0.2385	0.	275.656	1203.038	928.069	0.944
3	0.324	0.21080	0.2550	0.	361.123	1082.498	734.658	0.923
4	0.284	0.16709	0.1608	0.	514.933	950.888	471.453	1.262
5	0.221	-0.01127	-0.1426	0.	667.332	801.110	211.797	1.583

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.
1	0.7932	0.7996	1.245	1.082	0.	18.319
2	0.7783	0.7864	1.297	1.099	0.	21.596
3	0.6149	0.6290	1.301	1.127	0.	28.679
4	0.8513	0.8600	1.529	1.152	0.	30.966
5	0.8539	0.8632	1.592	1.167	0.	36.549

TRAVERSE PRESSURE RATIO	= 1.3818	FIXED INSTRUMENTATION PRESSURE RATIO	= 1.3750
TRAVERSE ADIABATIC EFF.	= 0.7887	ADIABATIC EFF.	= 0.7746
TRAVERSE POLYTROPIC EFF.	= 0.7582	POLYTROPIC EFF.	= 0.7845
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 223.78
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.00074
PERCENT DESIGN SPEED	= 100	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.99611

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0253	0.6873	0.1253	1.236	1.091
2	0.0355	0.6670	0.1769	1.294	1.115
3	0.0399	0.6705	0.1971	1.303	1.117
4	0.0175	0.9106	0.0738	1.524	1.140
5	0.0366	0.8611	0.1606	1.563	1.158

Table 6. - Listing of Blade Element Performance (continued).
NASA - TASK I (ROTOR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS
POINT NUMBER 18 READING NUMBER 161 DATE 6/14/1967

RADIAL POSITION	RFL. INLET FLOW ANG.	INCLD ANG MN.CMBR.LN	INCLD ANG SUCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY AT INLET	ROTOR SPD AT INLET	INLET ARS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	61.995	3.355	0.315	1.4071	1514.813	1336.530	712.983	0.662	710.785
2	58.952	3.622	-0.788	1.3193	1413.611	1211.038	729.165	0.681	729.054
3	56.638	4.388	-1.322	1.2221	1306.656	1089.696	721.049	0.674	717.483
4	54.279	4.569	-2.001	1.1110	1188.456	957.211	704.397	0.659	688.359
5	55.060	4.460	-2.820	0.9342	1010.274	806.437	608.534	0.563	563.424
RADIAL POSITION	RFL. EXIT FLOW ANG.	REL. DFV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY AT EXIT	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.620	4.260	9.376	0.7740	928.305	1321.852	812.813	0.678	563.070
2	47.335	3.045	11.617	0.7289	859.037	1211.730	821.844	0.697	582.171
3	41.390	5.220	15.248	0.5919	697.966	1103.068	828.617	0.703	523.227
4	29.026	5.576	25.253	0.6058	701.275	992.945	897.700	0.776	609.692
5	16.942	11.162	38.118	0.5602	642.113	884.975	934.124	0.815	598.890
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISF COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO	
1	0.528	0.36988	0.4877	0.	584.864	1336.530	736.988	0.792	
2	0.530	0.45815	0.5485	0.	580.068	1211.038	631.662	0.799	
3	0.616	0.52121	0.5822	0.	641.941	1089.696	461.127	0.729	
4	0.561	0.56845	0.5833	0.	654.628	957.211	338.317	0.886	
5	0.534	0.53567	0.4543	0.	702.539	806.437	182.436	1.063	
RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO		ABS. INLET FLOW ANG.	ABS. EXIT FLOW ANG.		
1	0.7693	0.7881	1.843	1.248		0.	46.088		
2	0.9069	0.9148	1.872	1.217		0.	44.896		
3	0.8272	0.8411	1.825	1.227		0.	50.818		
4	0.9202	0.9268	1.848	1.209		0.	47.036		
5	0.8782	0.8875	1.753	1.198		0.	49.554		
TRAVERSE PRESSURE RATIO	= 1.8330	FIXED INSTRUMENTATION	PRESSURE RATIO	= 1.8130					
TRAVERSE ADIABATIC EFF.	= 0.8532	ADIABATIC EFF.	= 0.8807						
TRAVERSE POLYTROPIC EFF.	= 0.8651	POLYTROPIC EFF.	= 0.8902						
FLOW COEFFICIENT L.E.	= 0.980	NOZZLE WEIGHT FLOW	= 221.55						
FLOW COEFFICIENT T.E.	= 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 1.00446						
PERCENT DESIGN SPEED	= 100	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW	= 0.97483						

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS FRACTION	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0459	0.7708	0.2063	1.792	1.235
2	0.0232	0.8912	0.1021	1.855	1.217
3	0.0292	0.8735	0.1283	1.821	1.214
4	0.0073	0.9717	0.0310	1.840	1.196
5	0.0180	0.9394	0.0803	1.740	1.183

Table 6. - Listing of Blade Element Performance (continued).
NASA - TASK I (ROTDR 2B)

N.A.S.A. COMPRESSOR OUTPUT DATA
BLADE ELEMENT PERFORMANCE RESULTS

POINT NUMBER 19 READING NUMBER 162 DATE 6/14/1967

RADIAL POSITION	REL. INLET FLOW ANG.	INCID ANG MN.CMBR.IN	INCID ANG SHCT.SURF	INLET REL MACH NO.	INLET REL VELOCITY	ROTOR SPD AT INLET	INLET ABS VELOCITY	INLET ABS MACH NO.	INLET AX. VELOCITY
1	62.276	3.636	0.596	1.4023	1510.783	1336.442	704.548	0.654	702.376
2	59.271	3.941	-0.469	1.3133	1408.811	1210.959	719.950	0.671	719.841
3	57.284	5.034	-0.676	1.2090	1296.956	1089.624	703.430	0.656	699.952
4	55.462	5.752	-0.818	1.0891	1170.710	957.148	674.114	0.627	658.765
5	56.012	5.412	-1.868	0.9195	997.518	806.384	587.187	0.541	543.659

RADIAL POSITION	REL. EXIT FLOW ANG.	REL. DFV. ANG. T.E.	REL. TURN ANGLE	EXIT REL. MACH NO.	EXIT REL. VELOCITY	ROTOR SPD AT EXIT	EXIT ABS VELOCITY	EXIT ABS MACH NO.	EXIT AX. VELOCITY
1	52.716	4.356	9.560	0.7304	880.754	1321.765	819.735	0.680	533.058
2	46.772	2.482	12.499	0.6899	817.333	1211.650	832.457	0.703	559.781
3	40.321	4.151	16.963	0.5690	672.734	1102.995	842.408	0.713	512.504
4	28.427	4.977	27.035	0.5791	672.602	992.880	897.809	0.773	588.082
5	15.734	9.954	40.279	0.5373	617.417	884.916	935.664	0.814	579.250

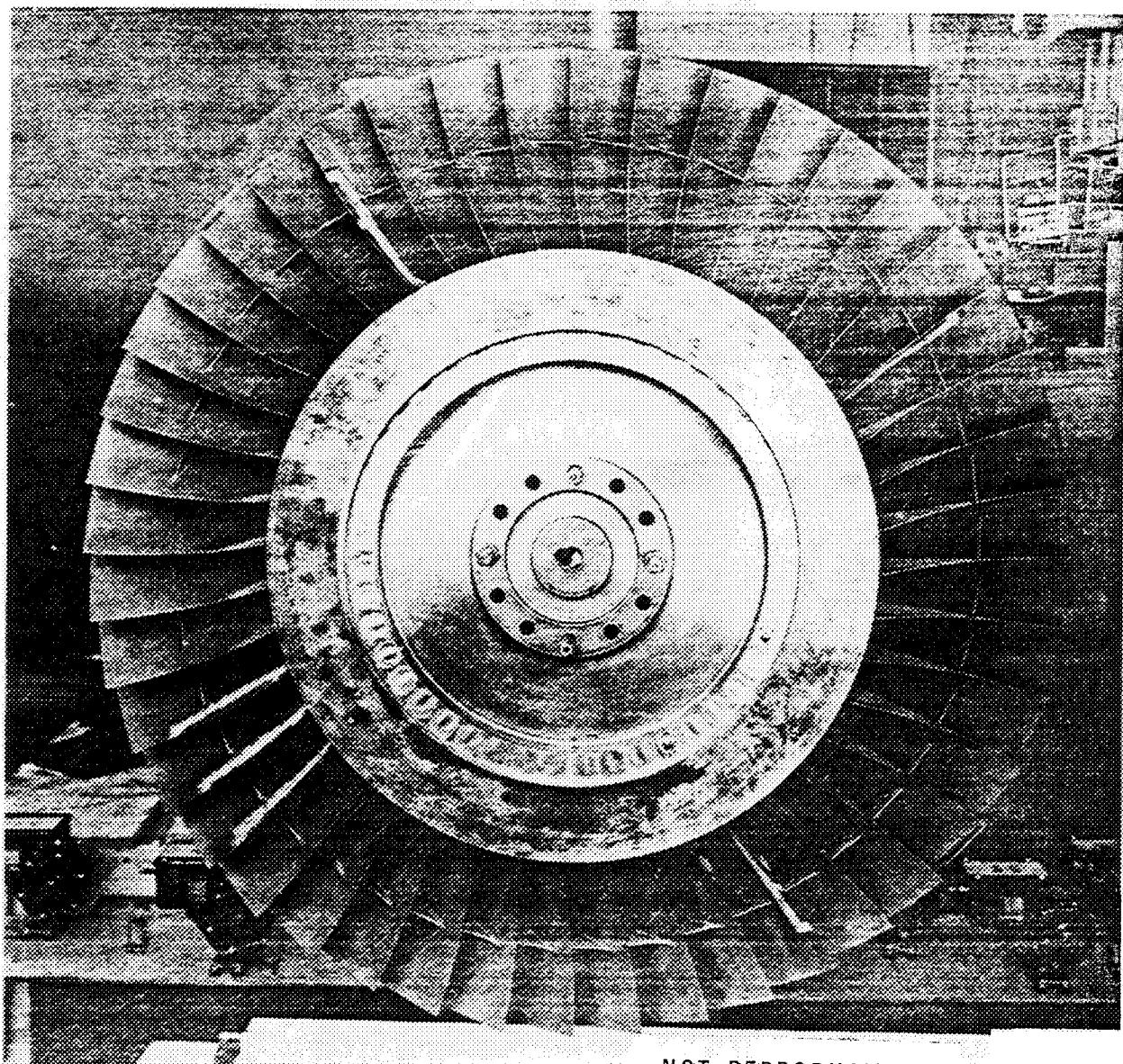
RADIAL POSITION	DIFFUSION FACTOR	ST. PRESS RISE COEFF	CH1	INLET ABS TANG. VEL	EXIT ABS TANG. VEL	INLET REL TANG. VEL	EXIT REL TANG. VEL	AXIAL VEL.RATIO
1	0.567	0.39939	0.5175	0.	621.631	1336.442	700.134	0.759
2	0.566	0.48168	0.5706	0.	616.122	1210.959	595.528	0.778
3	0.638	0.54162	0.5998	0.	668.035	1089.624	434.960	0.732
4	0.584	0.58528	0.5955	0.	674.542	957.148	318.338	0.893
5	0.558	0.56923	0.4821	0.	721.730	806.384	163.187	1.065

RADIAL POSITION	ADIABATIC EFFICIENCY	POLYTROPIC EFFICIENCY	TOT. PRESS RATIO	TOT. TEMP RATIO	Abs. INLET FLOW ANG.	Abs. EXIT FLOW ANG.
1	0.7769	0.7962	1.917	1.263	0.	49.386
2	0.8936	0.9029	1.930	1.231	0.	47.743
3	0.8443	0.8574	1.878	1.234	0.	52.505
4	0.9236	0.9301	1.876	1.213	0.	48.917
5	0.8987	0.9066	1.791	1.202	0.	51.250

TRAVERSE PRESSURE RATIO = 1.8846	FIXED INSTRUMENTATION PRESSURE RATIO = 1.8580
TRAVERSE ADIABATIC EFF. = 0.8589	ADIABATIC EFF. = 0.8862
TRAVERSE POLYTROPIC EFF. = 0.8709	POLYTROPIC EFF. = 0.8957
FLOW COEFFICIENT L.E. = 0.980	NOZZLE WEIGHT FLOW = 219.22
FLOW COEFFICIENT T.E. = 0.950	L.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.99982
PERCENT DESIGN SPEED = 100	T.E. CHECK WEIGHT FLOW/NOZ. WEIGHT FLOW = 0.96541

PARAMETERS DETERMINED FROM FIXED INSTRUMENTATION

RADIAL POSITION	TOT. PRESS LOSS PARAM	ADIABATIC EFFICIENCY	LOSS COEFFICIENT	TOT. PRESS RATIO	TOT. TEMP RATIO
1	0.0462	0.7805	0.2081	1.866	1.250
2	0.0242	0.8927	0.1054	1.912	1.228
3	0.0289	0.8812	0.1253	1.863	1.221
4	0.0064	0.9762	0.0271	1.861	1.199
5	0.0142	0.9539	0.0631	1.763	1.184



NOT REPRODUCIBLE

Figure 1(a). - Overall view of Rotor 2B, aft looking forward.

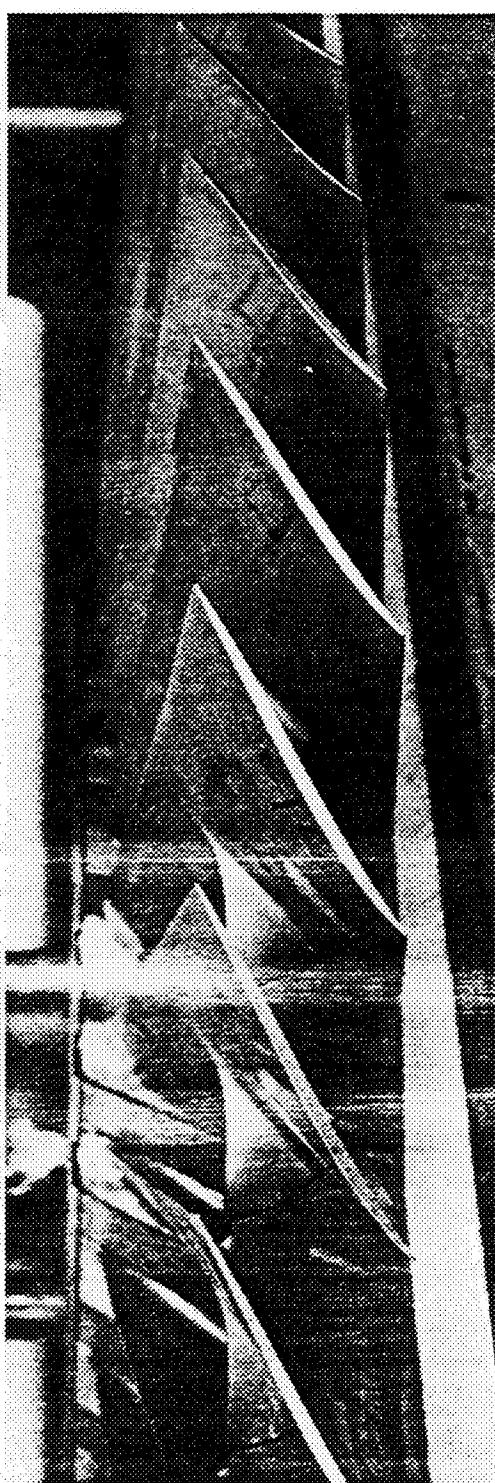


Figure 1(b). - Close-up view of rotor tip.

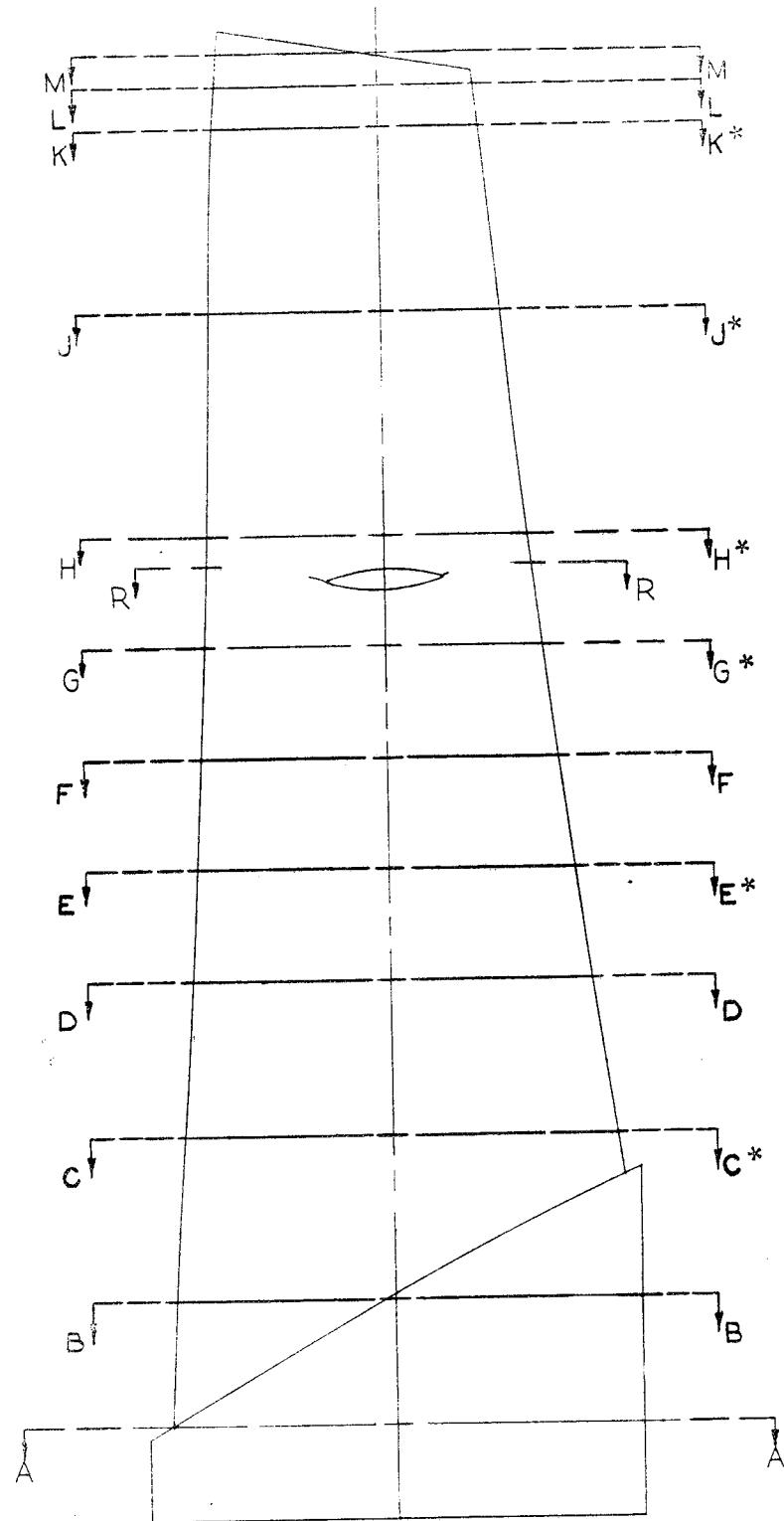


Figure 2. - Meridional view of rotor. Probograph inspection sections are indicated by asterisks.

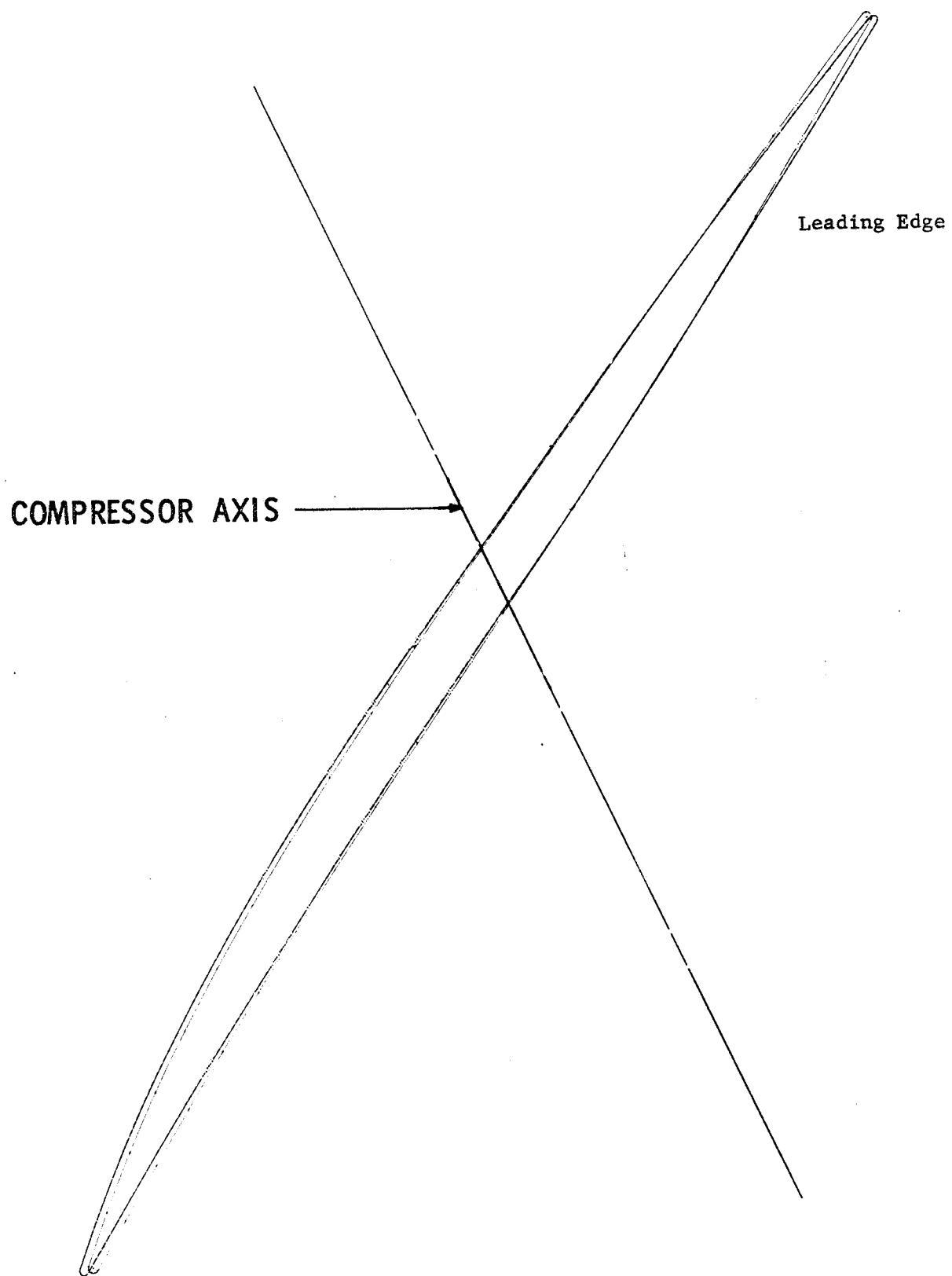


Figure 3(a). - Cylindrical cut of blade at section KK. The solid line represents design intent and the dashed line represents the average of six measured samples

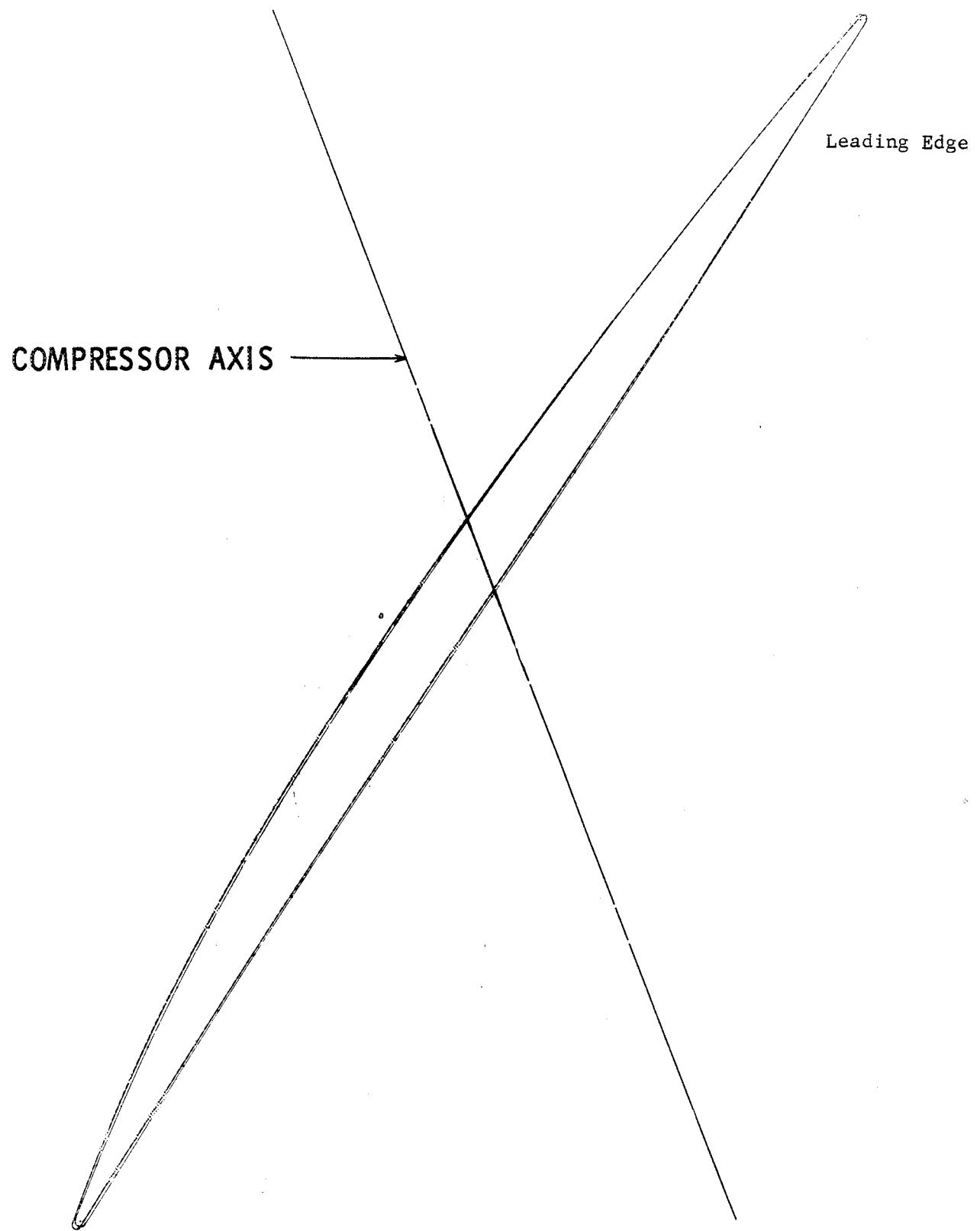


figure 3(b). - Cylindrical cut of blade at section JJ. The solid line represents design intent and the dashed line represents the average of six measured samples.

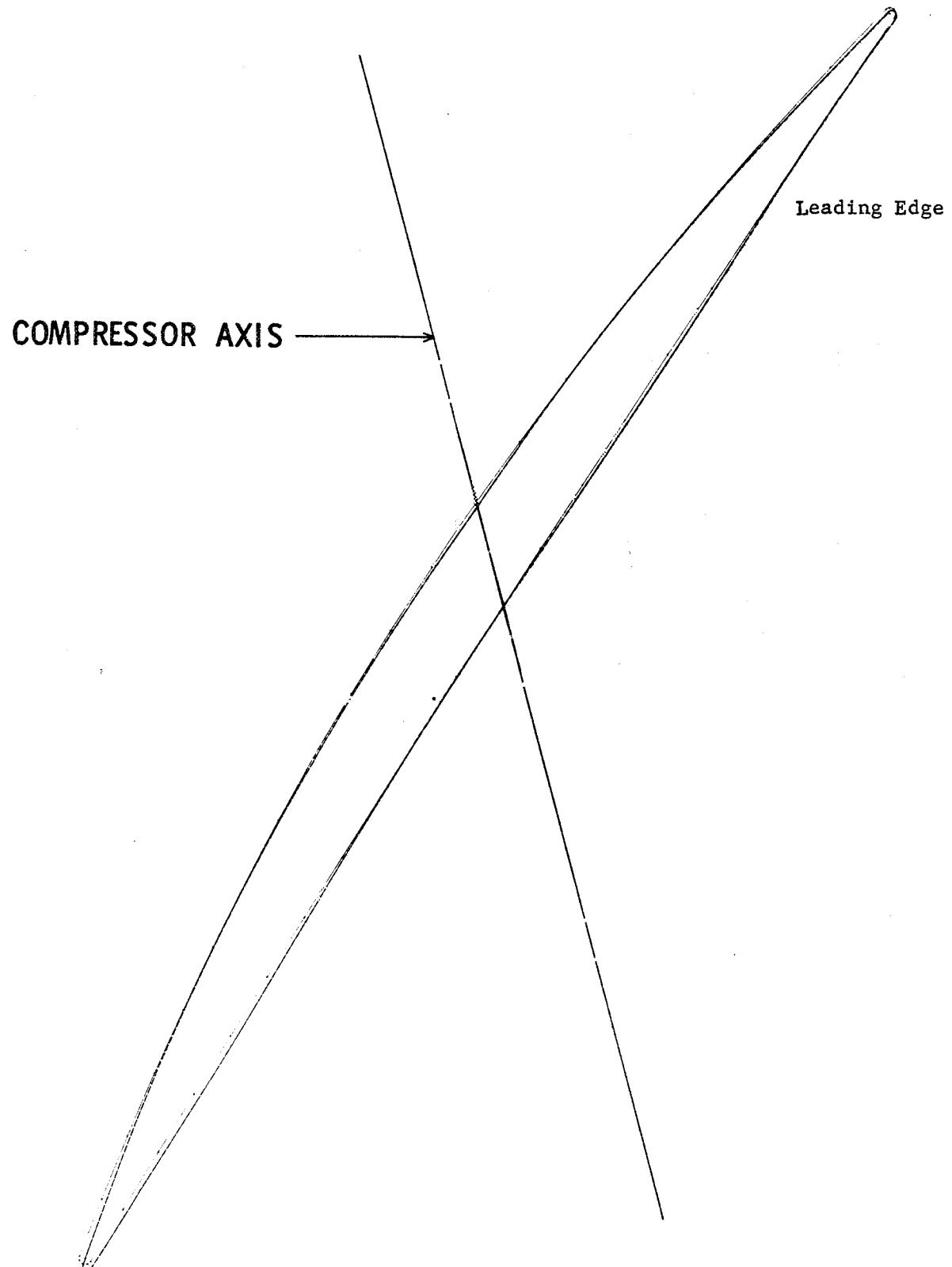


Figure 3(c). - Cylindrical cut of blade at section HH. The solid line represents design intent and the dashed line represents the average of six measured samples.

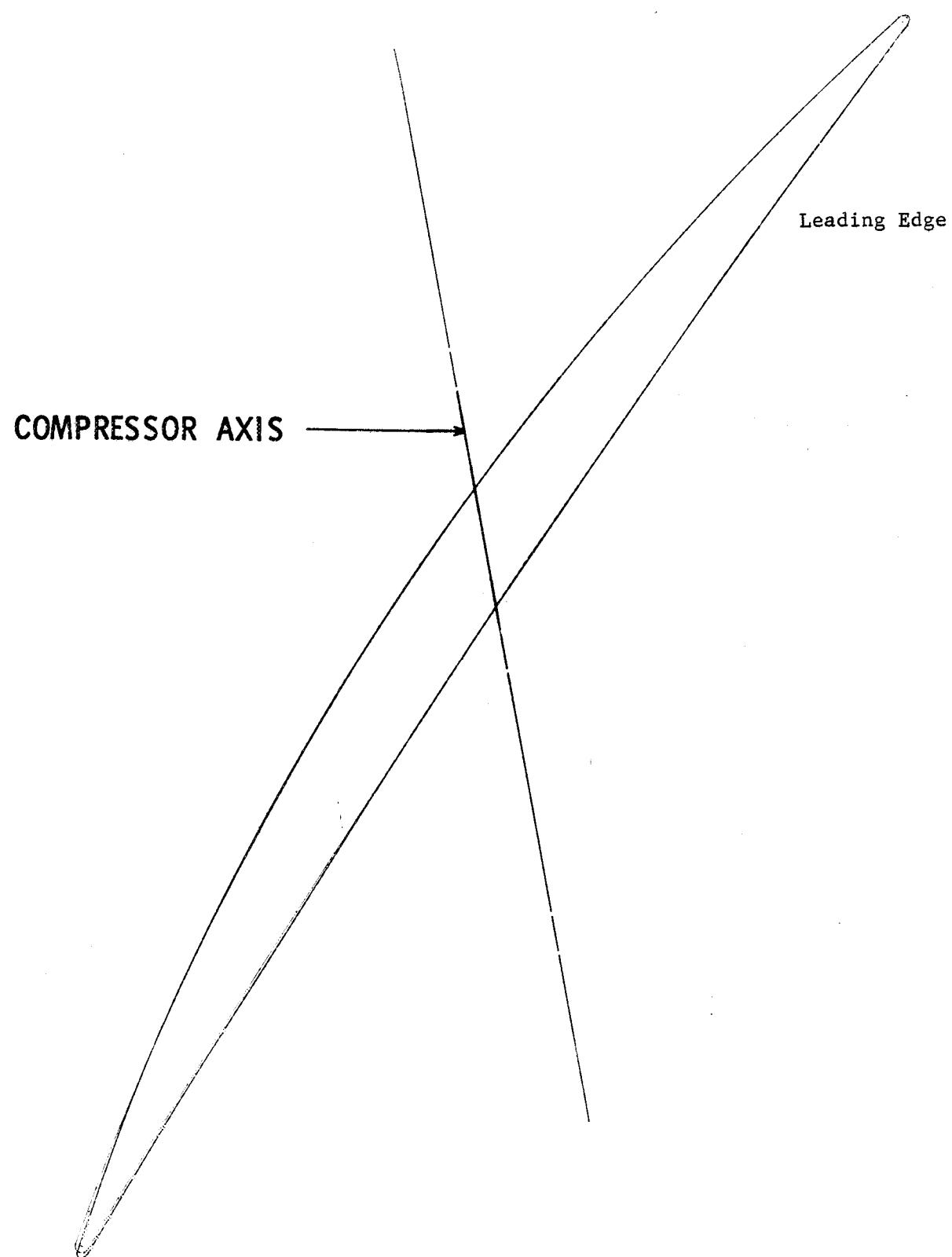


figure 3(d). - Cylindrical cut of blade at section GG. The solid line represents design intent and the dashed line represents the average of six measured samples.

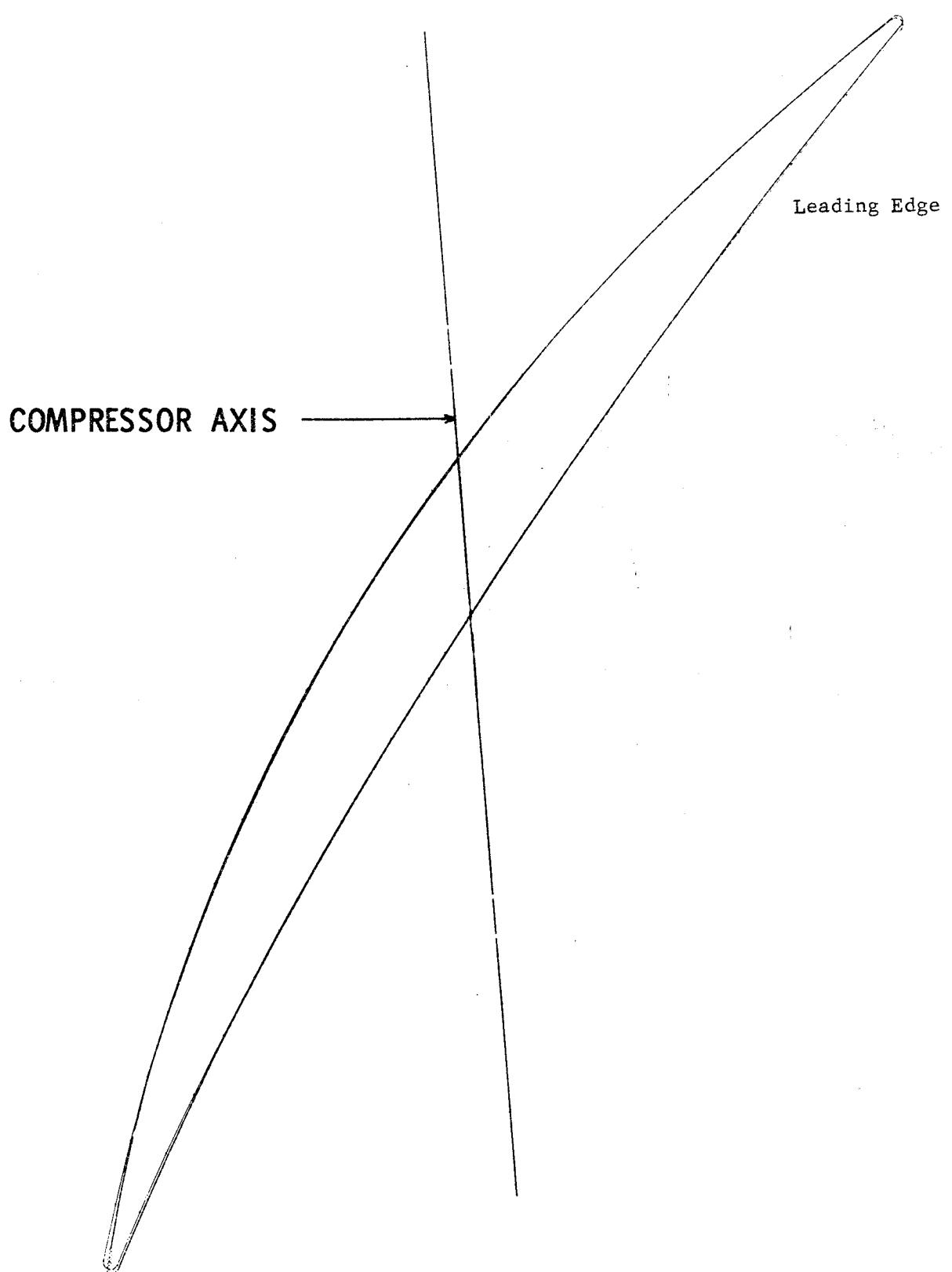


Figure 3(e). - Cylindrical cut of blade at section EE. The solid line represents design intent and the dashed line represents the average of six measured samples.

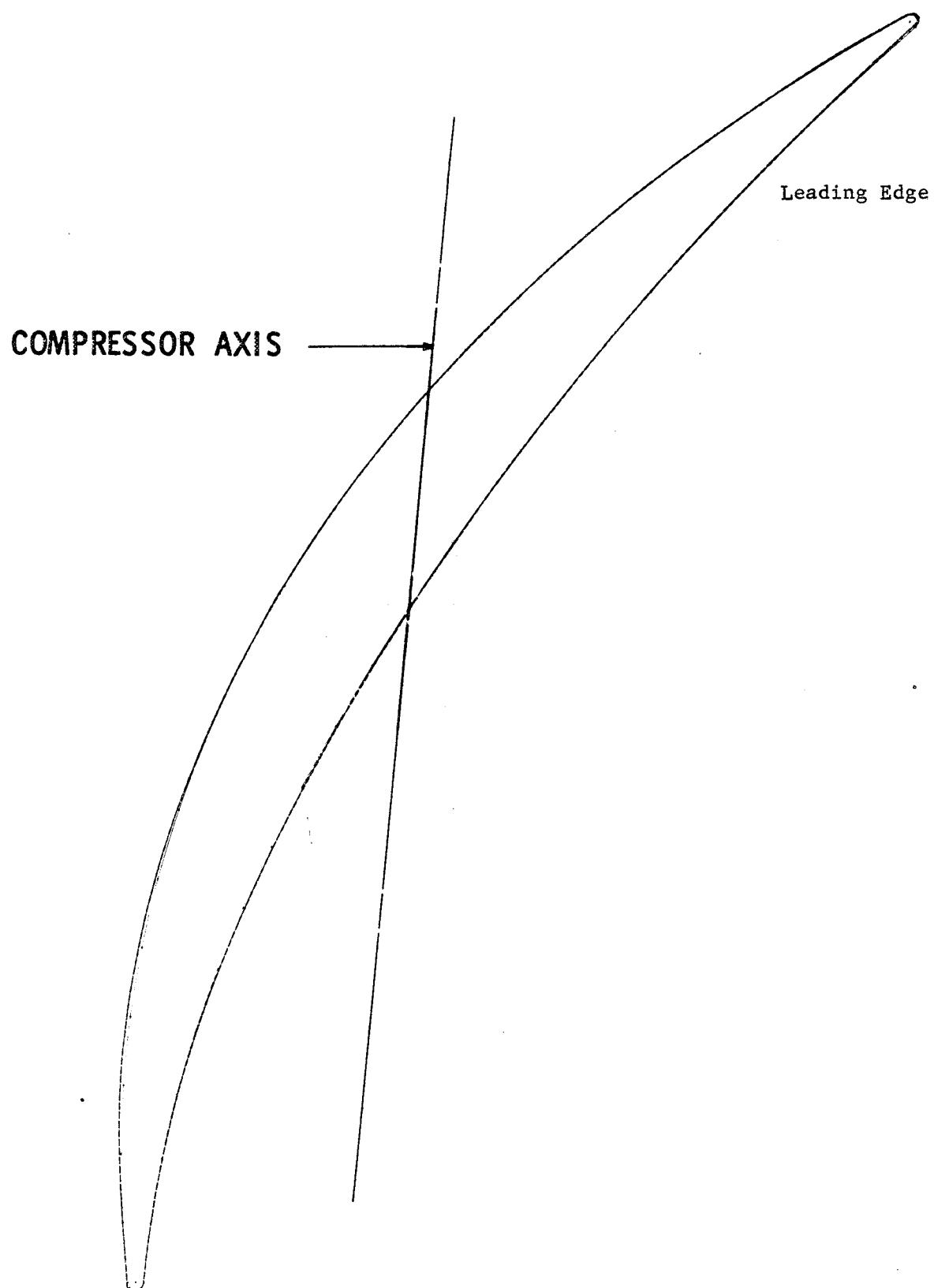


Figure 3(f). - Cylindrical cut of blade at section CC. The solid line represents design intent and the dashed line represents the average of six measured samples.

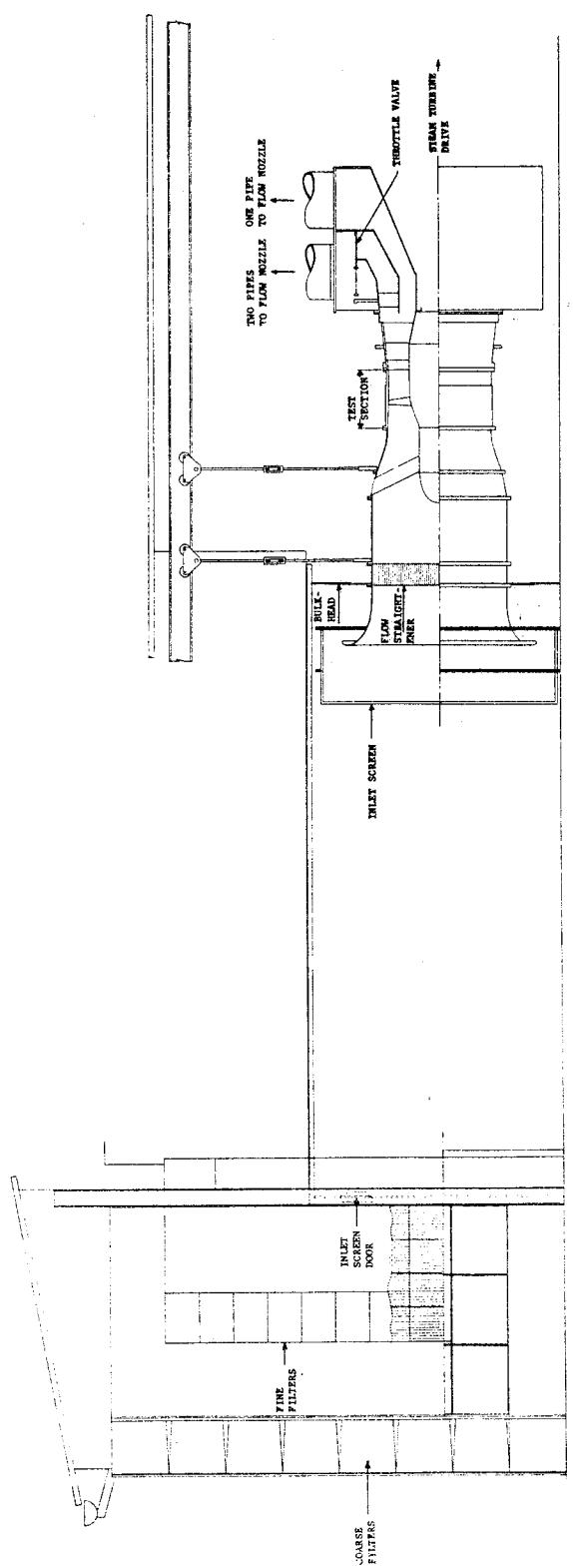
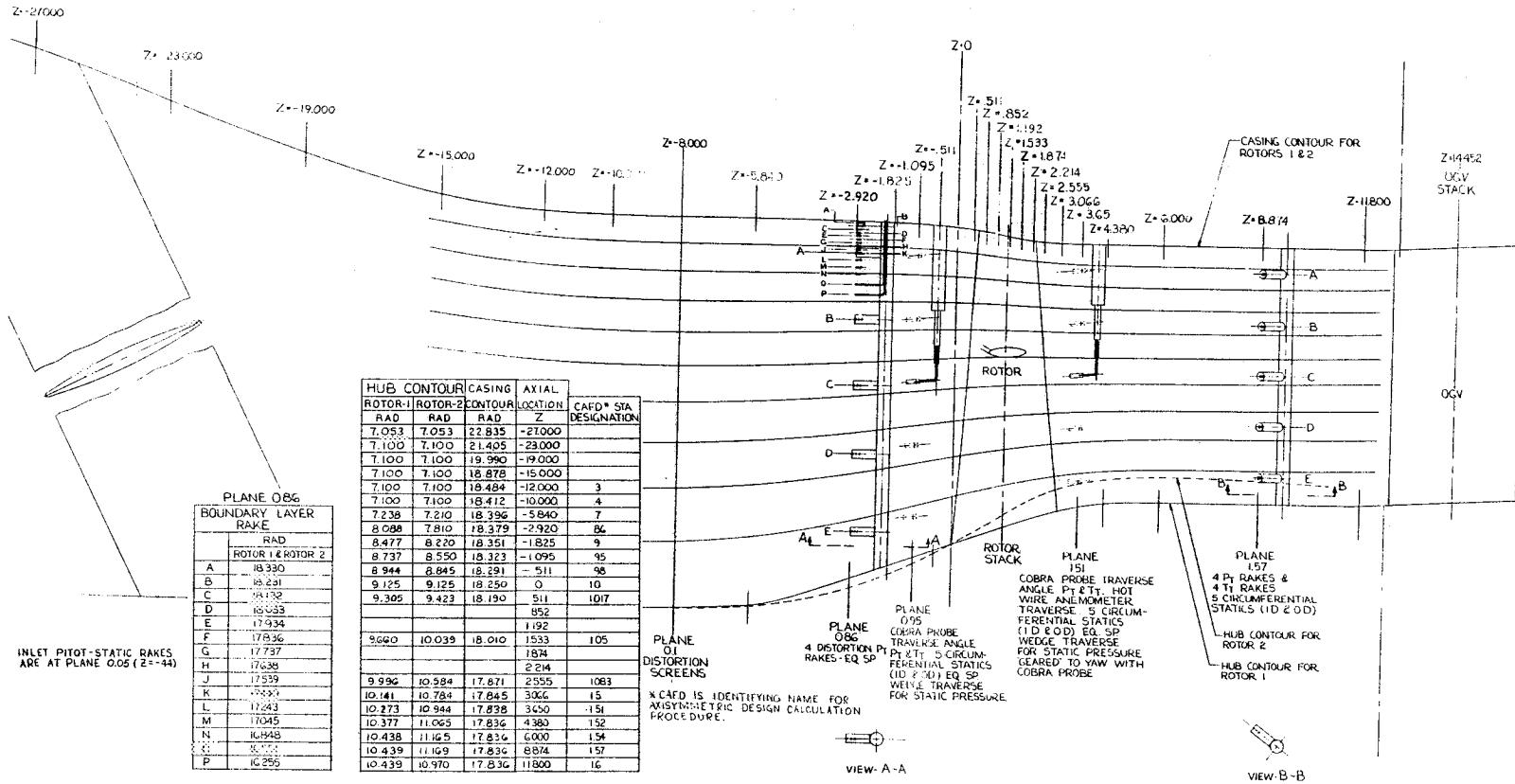


Figure 4. - House Compressor Test Facility.

Figure 5. - Meridional view showing location of instrumentation.



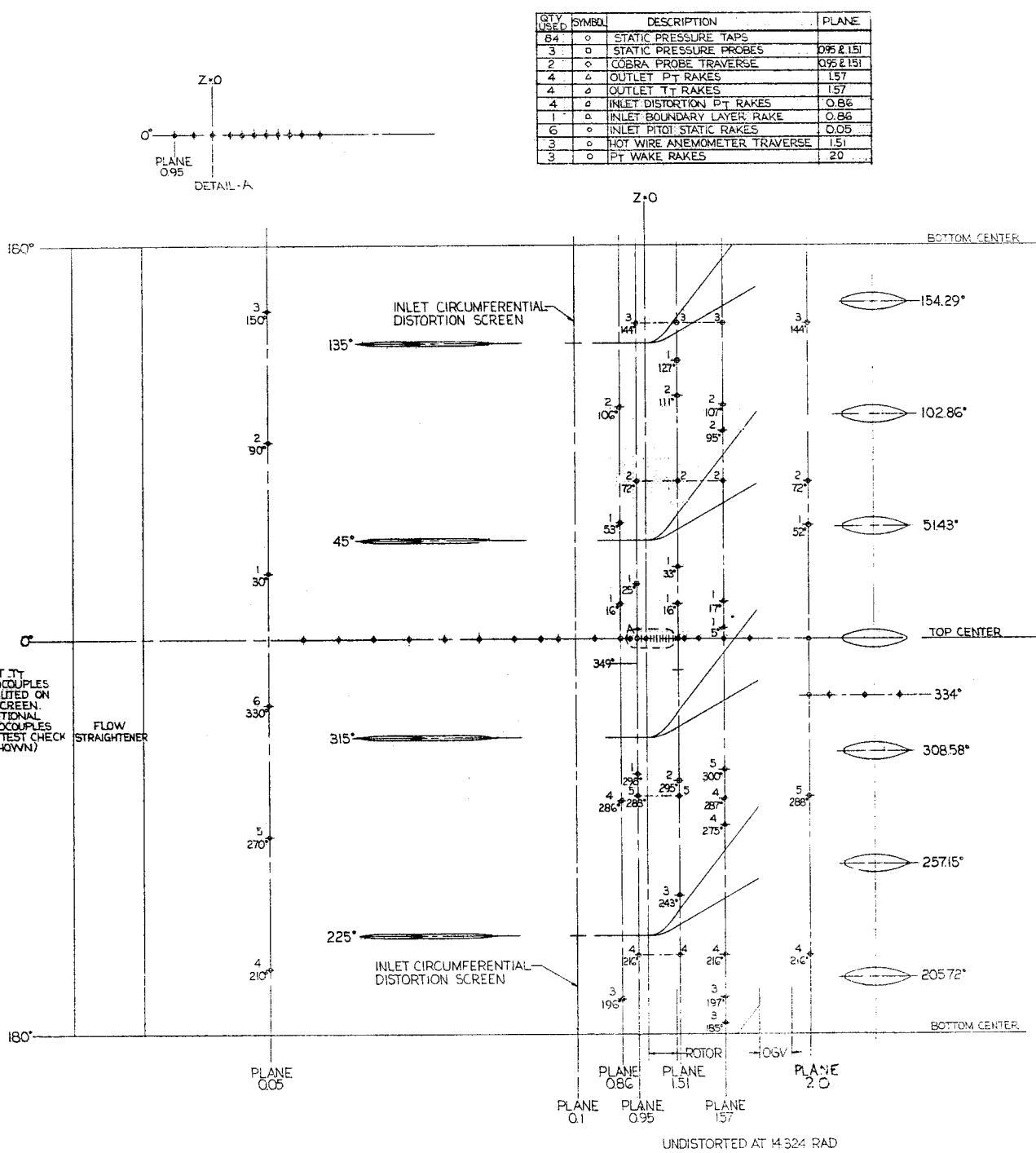
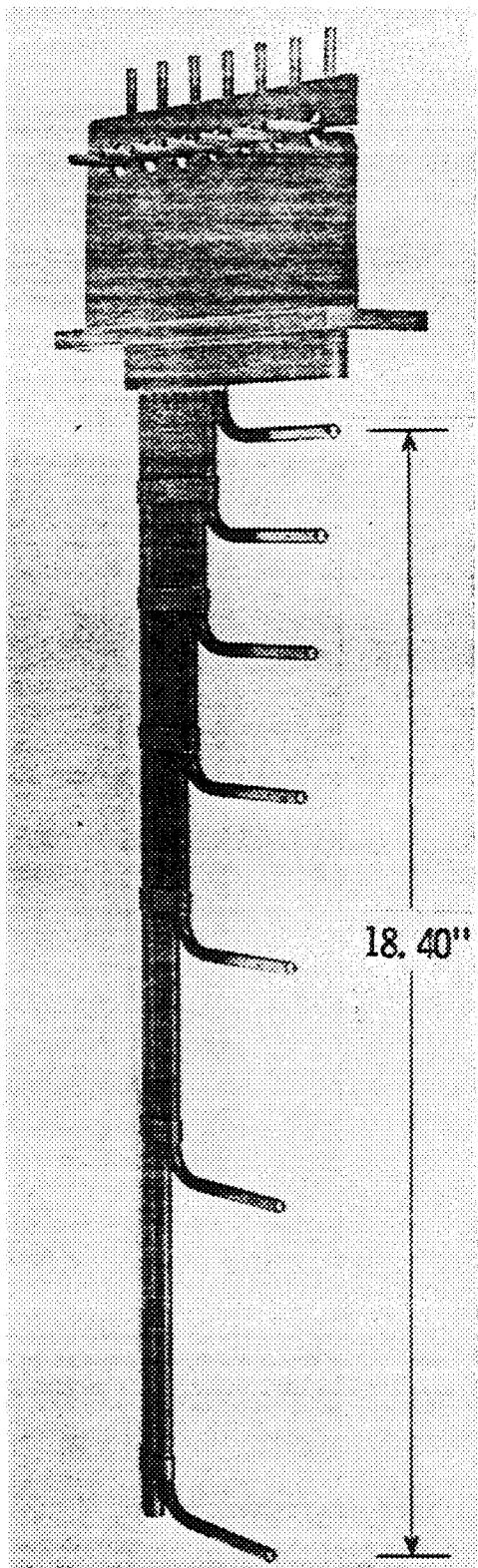
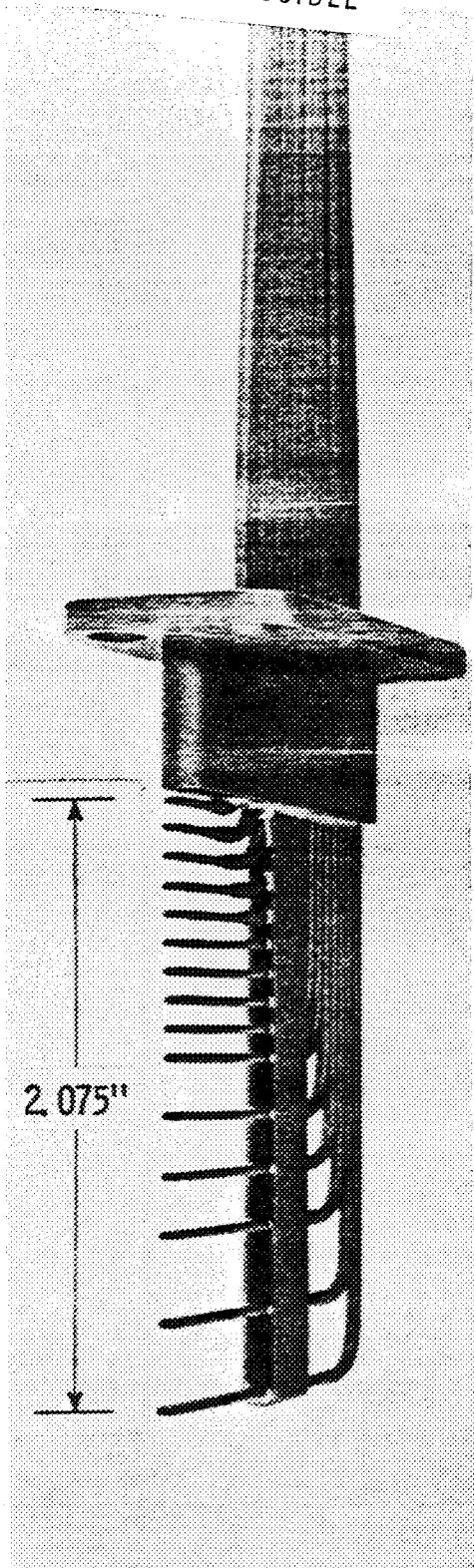


Figure 6. - Development showing circumferential location of instrumentation.

NOT REPRODUCIBLE

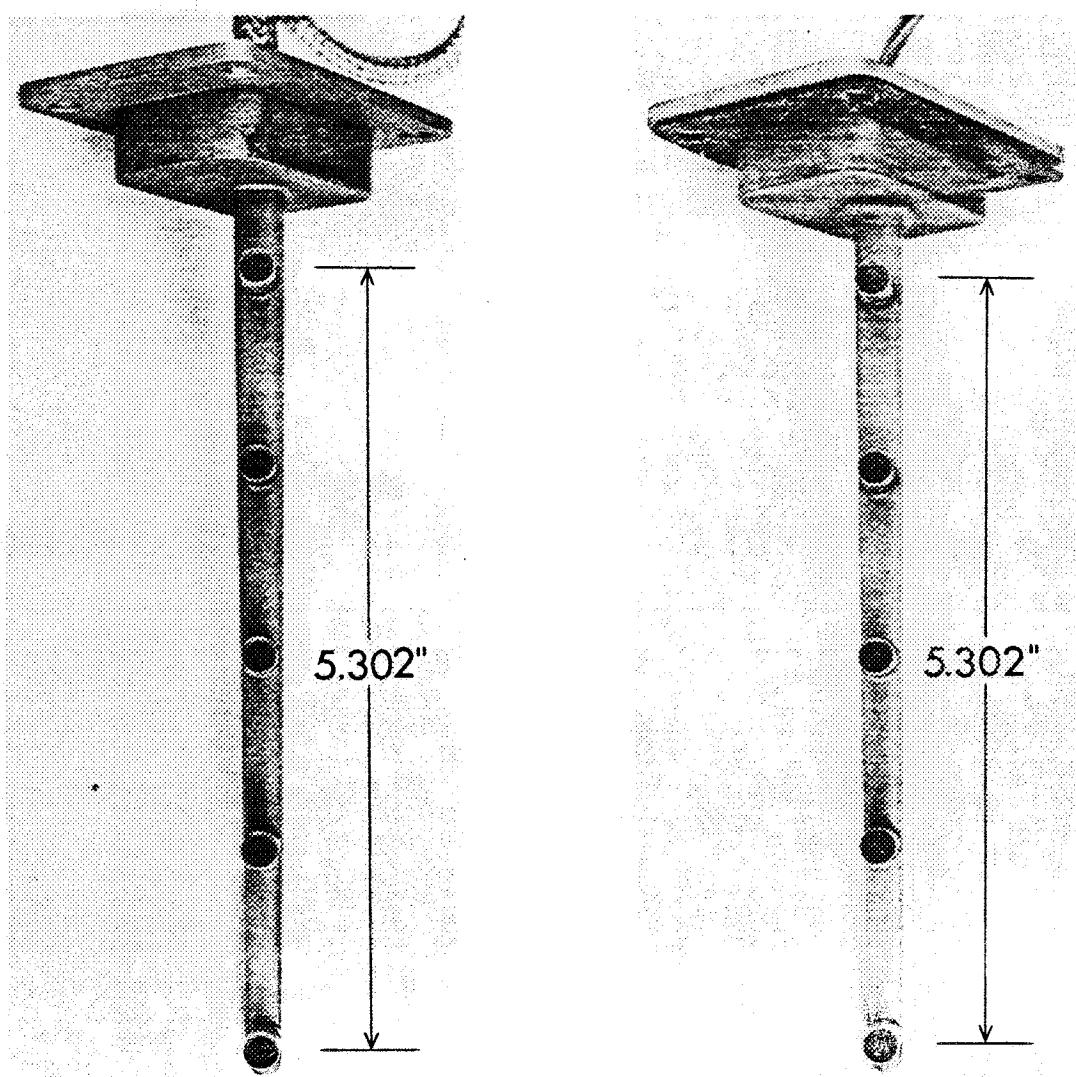


(a). - Inlet pitot-static rake.



(b). - Casing boundary layer rake.

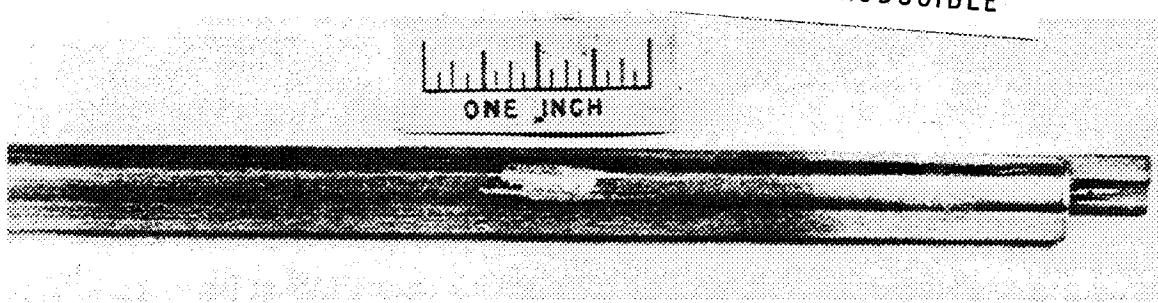
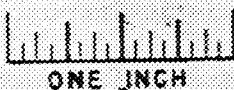
Figure 7. - Photographs of fixed instrumentation.



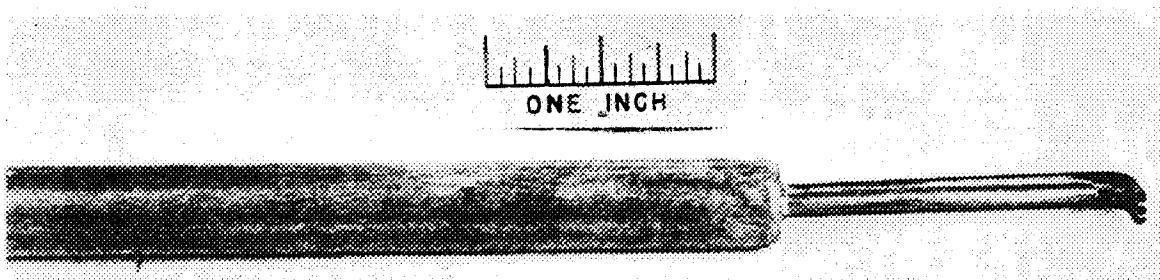
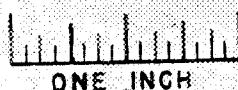
(c). Discharge total temperature rake. (d). Discharge total pressure rake.

Figure 7. - Photographs of fixed instrumentation.

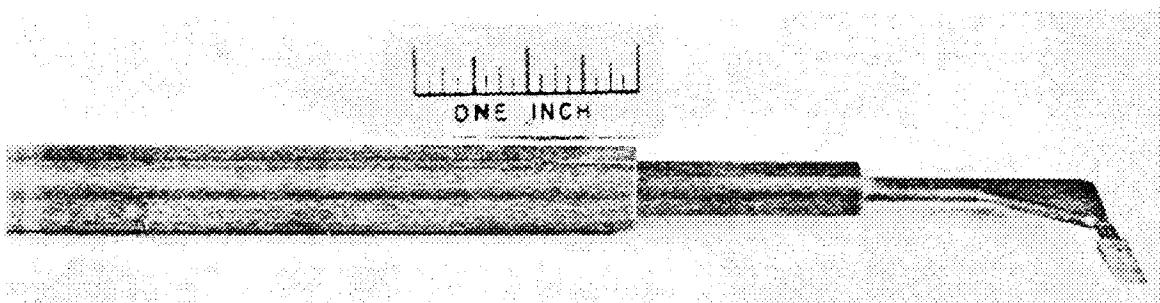
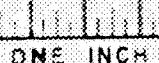
NOT REPRODUCIBLE



(a). - Shielded hot wire probe.



(b). - Cobra probe for sensing flow angle, total pressure
and total temperature.



(c). - Wedge probe for sensing static pressure.

Figure 8. - Photographs of traverse instrumentation.

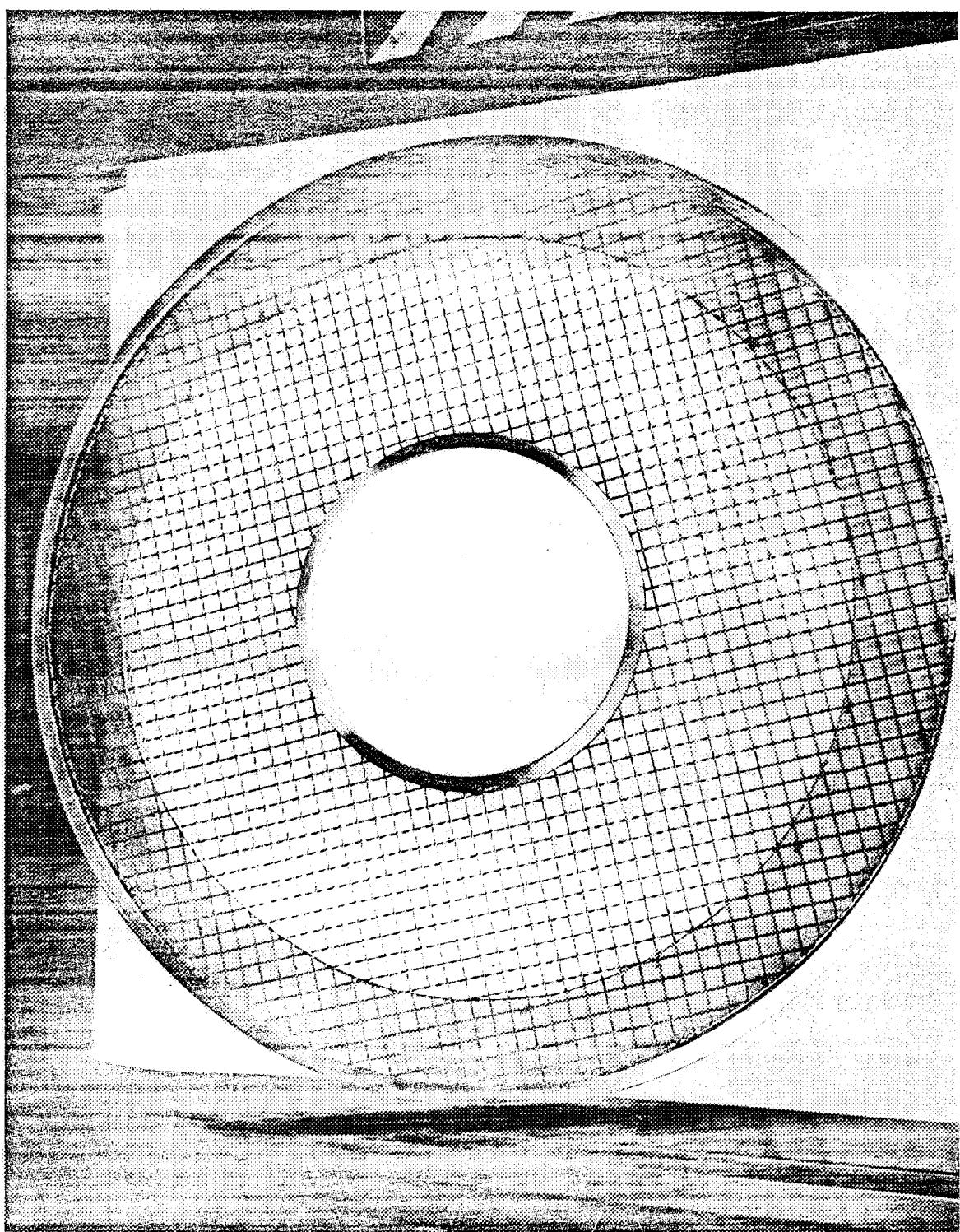


Figure 9(a). - Support screen with radial distortion screen attached.

NOT REPRODUCIBLE

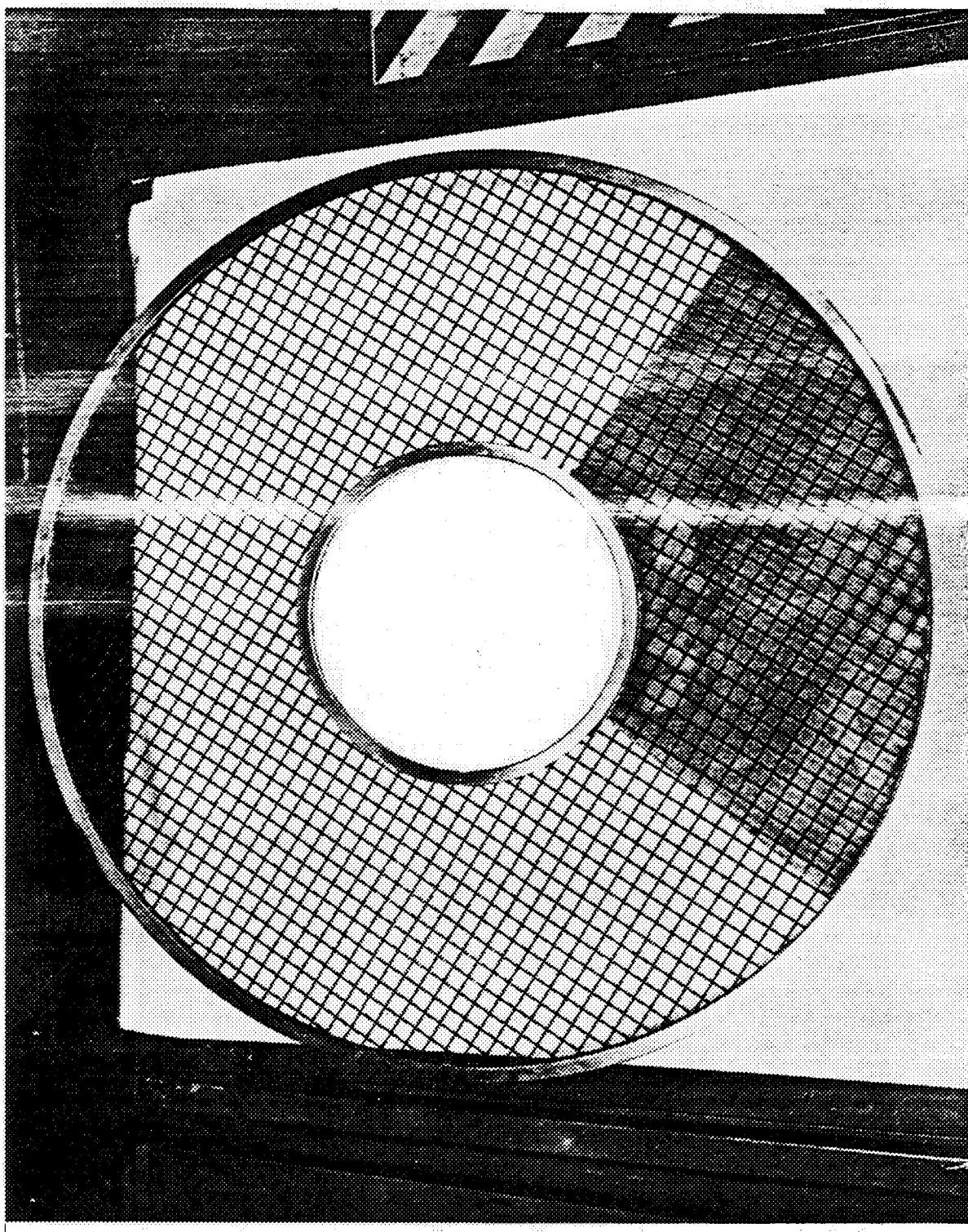


Figure 9(b). - Support screen with circumferential distortion screen attached.

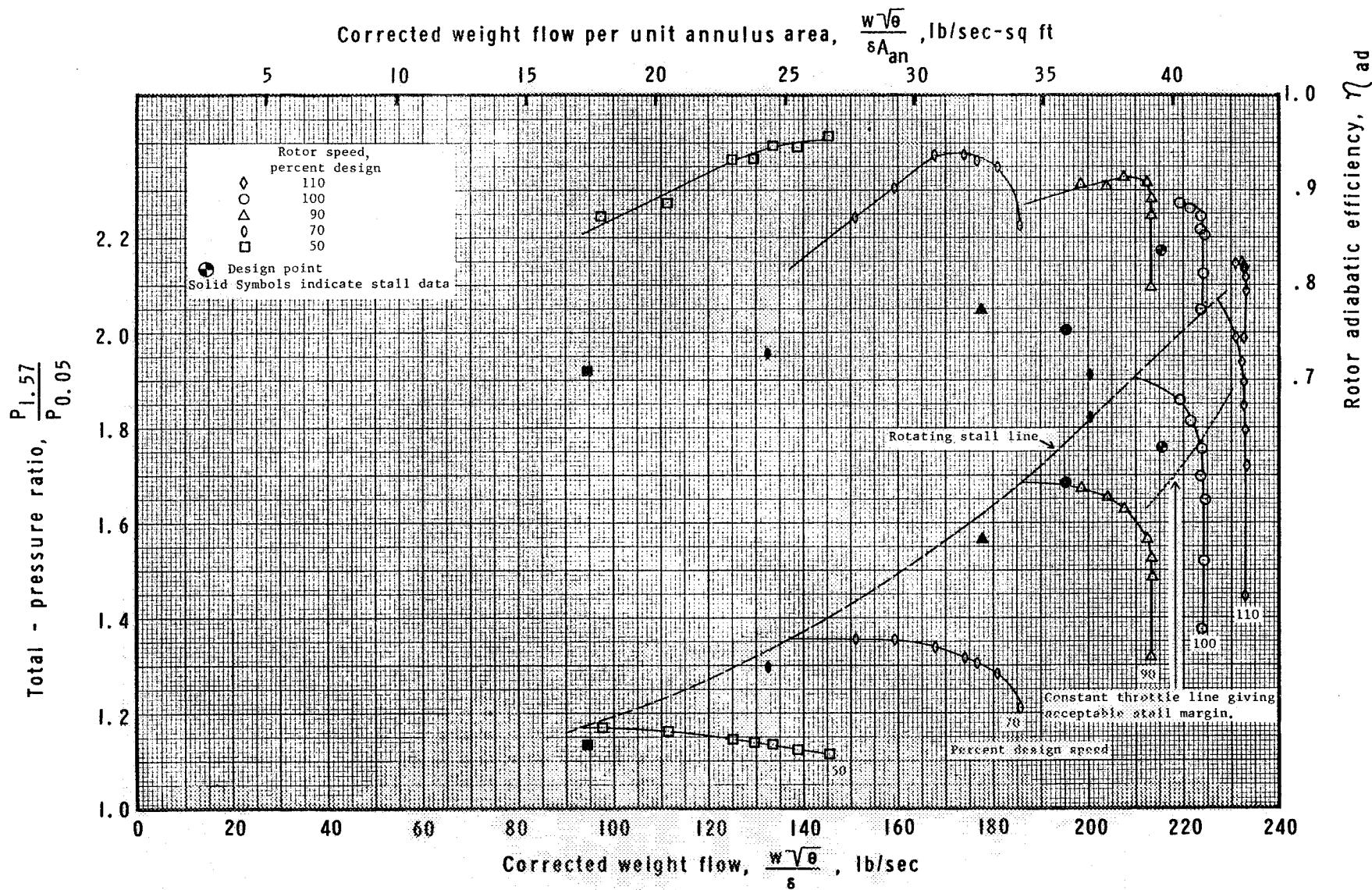
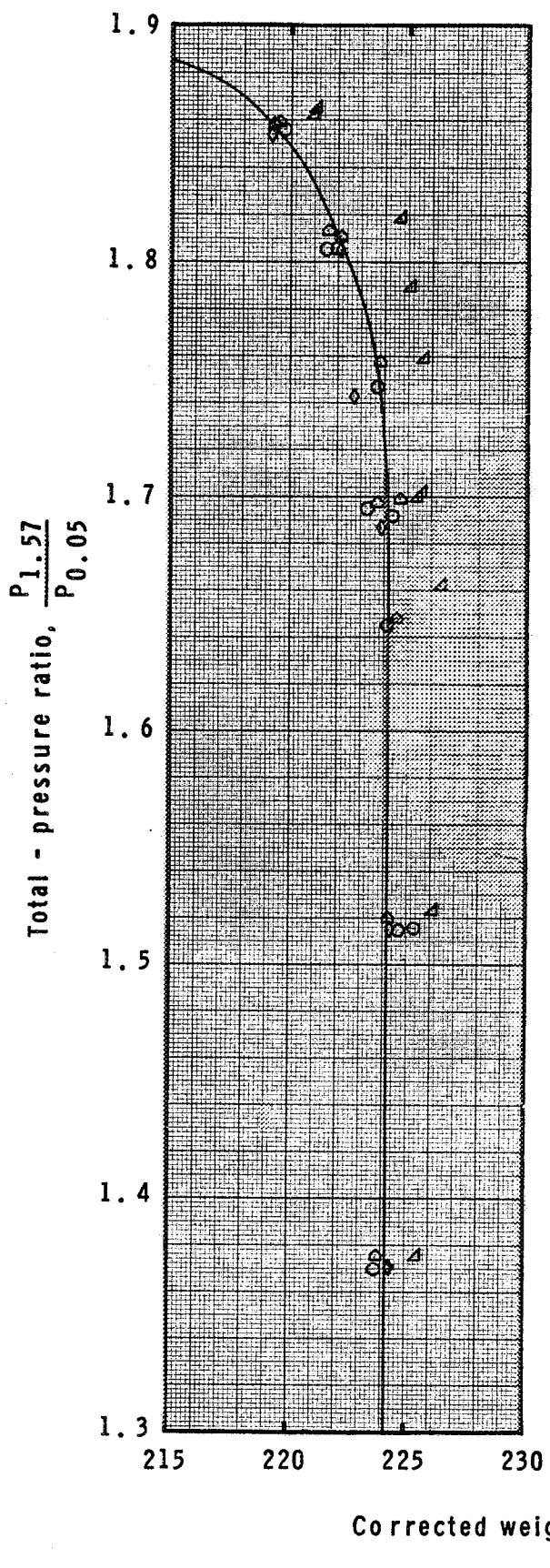


Figure 10. - Rotor performance map obtained with uniform inlet flow.



LEGEND	STRAIGHTENER	DATA
▲ Original Run	Yes	Table 2A
○ F/S Removed	No	Table 2B
◊ Final Run	No	Table 2C
△ Final Run	Yes	Table 2D

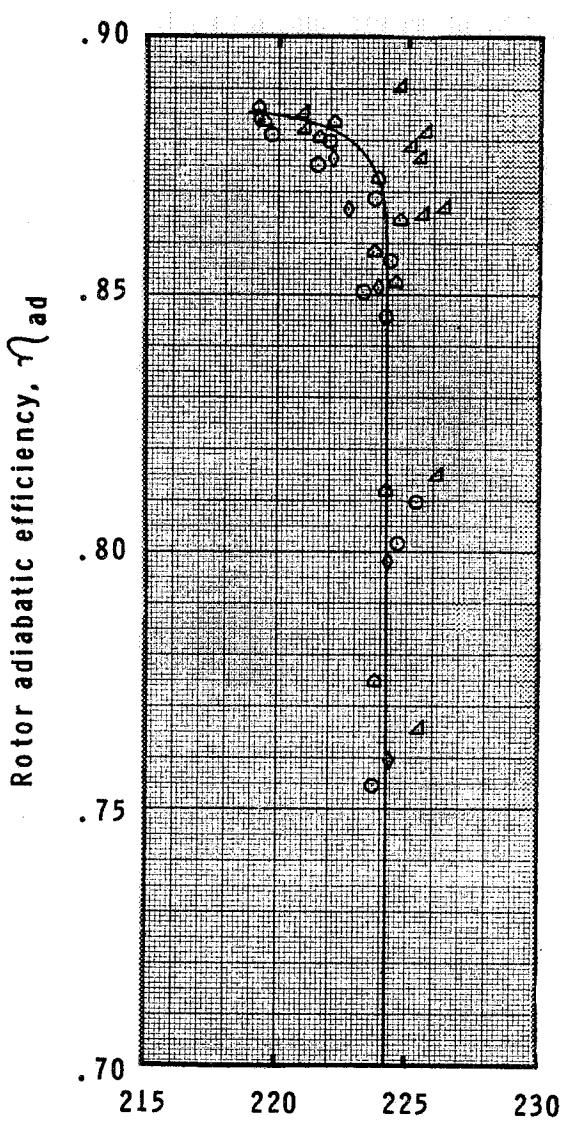
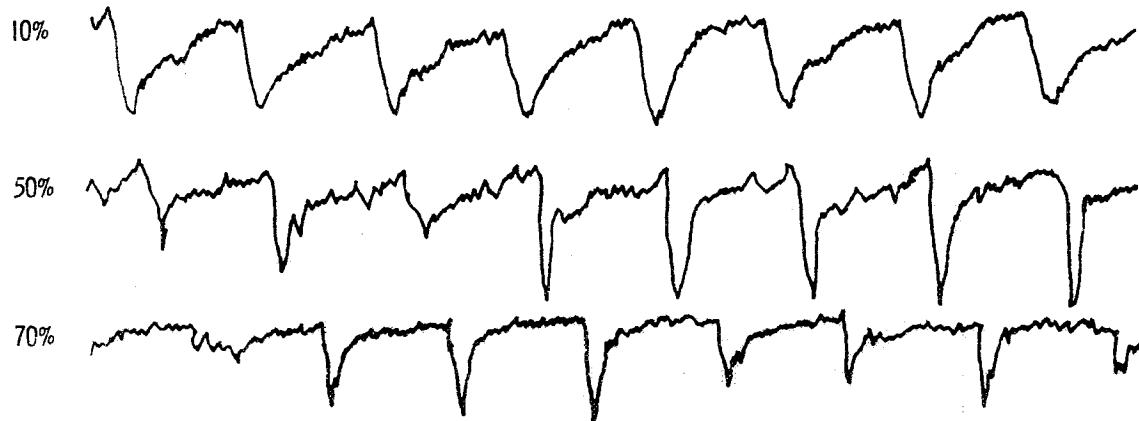


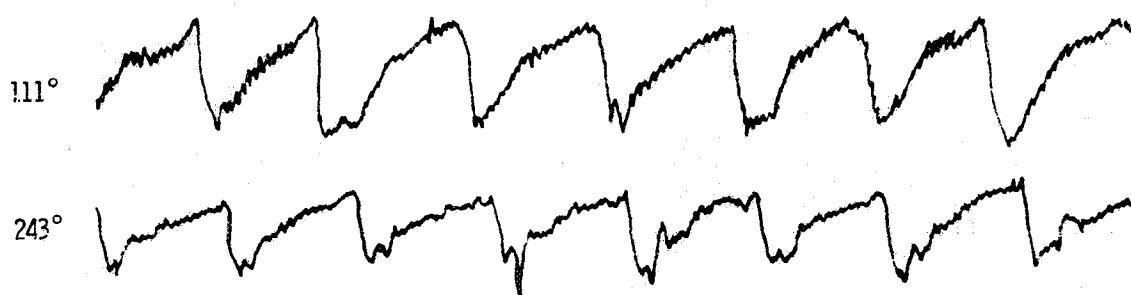
Figure 11. - Performance history of Rotor 2B at design speed with uniform inlet flow.

Immersion



(a) Sample of hot wire anemometer traces at 90 percent design rotor speed.

Circumferential probe position



(b) Sample of hot wire anemometer traces from 10 percent immersion at 90 percent design rotor speed.

Rotor speed, percent design	Number of stall cells	Stall cell speed Rotor speed	Radial extent of stall cell	Throttle setting at stall
50	3	.64	Full span	3.00
70	2	.63	Full span	4.15
90	1	.62	Full span	7.25
100	2	.62	Full span	8.50
110	1	.61	Uncertain	8.90

(c) Tabulation of stall data

Figure 12. - Sample hot-wire traces and tabulation of stall data.

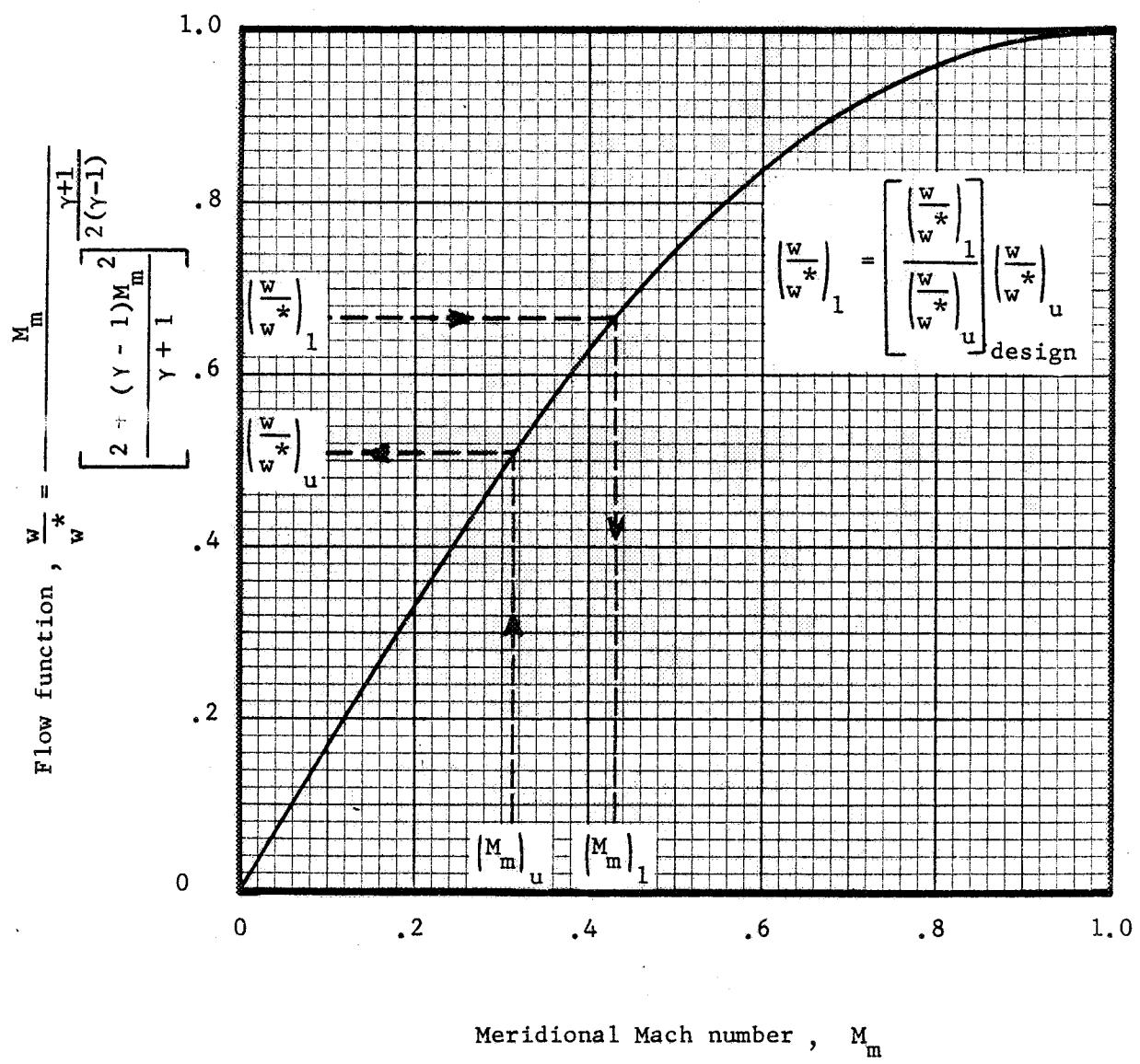


Figure 11. - Relationship between flow function and meridional Mach number - used for transferring traverse measurements to blade edges. Dashed lines with arrows and inset formulas indicate calculation sequence for sample case at leading edge.

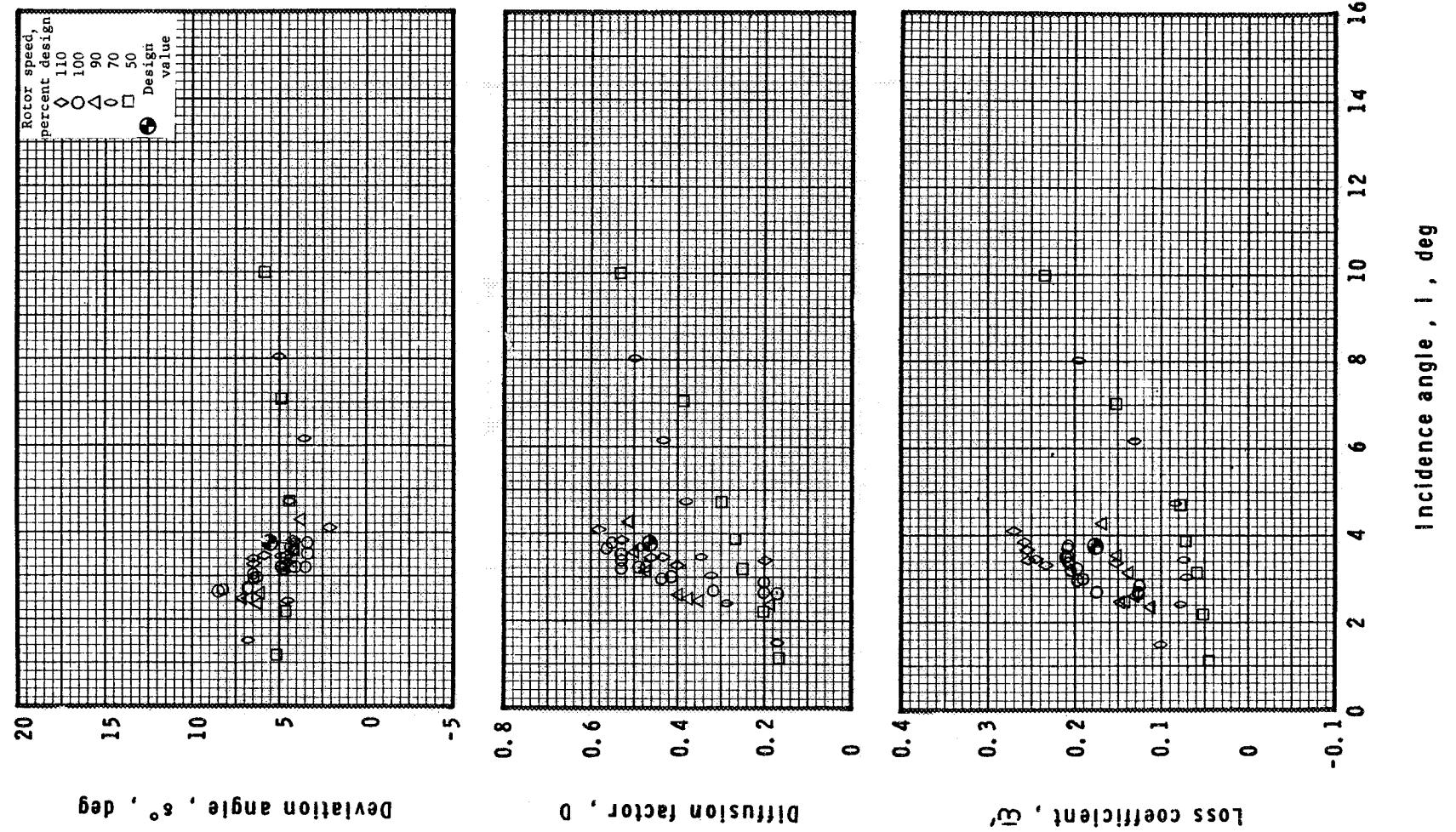


Figure 14(a). - Blade element data measured at 10% immersion from tip.

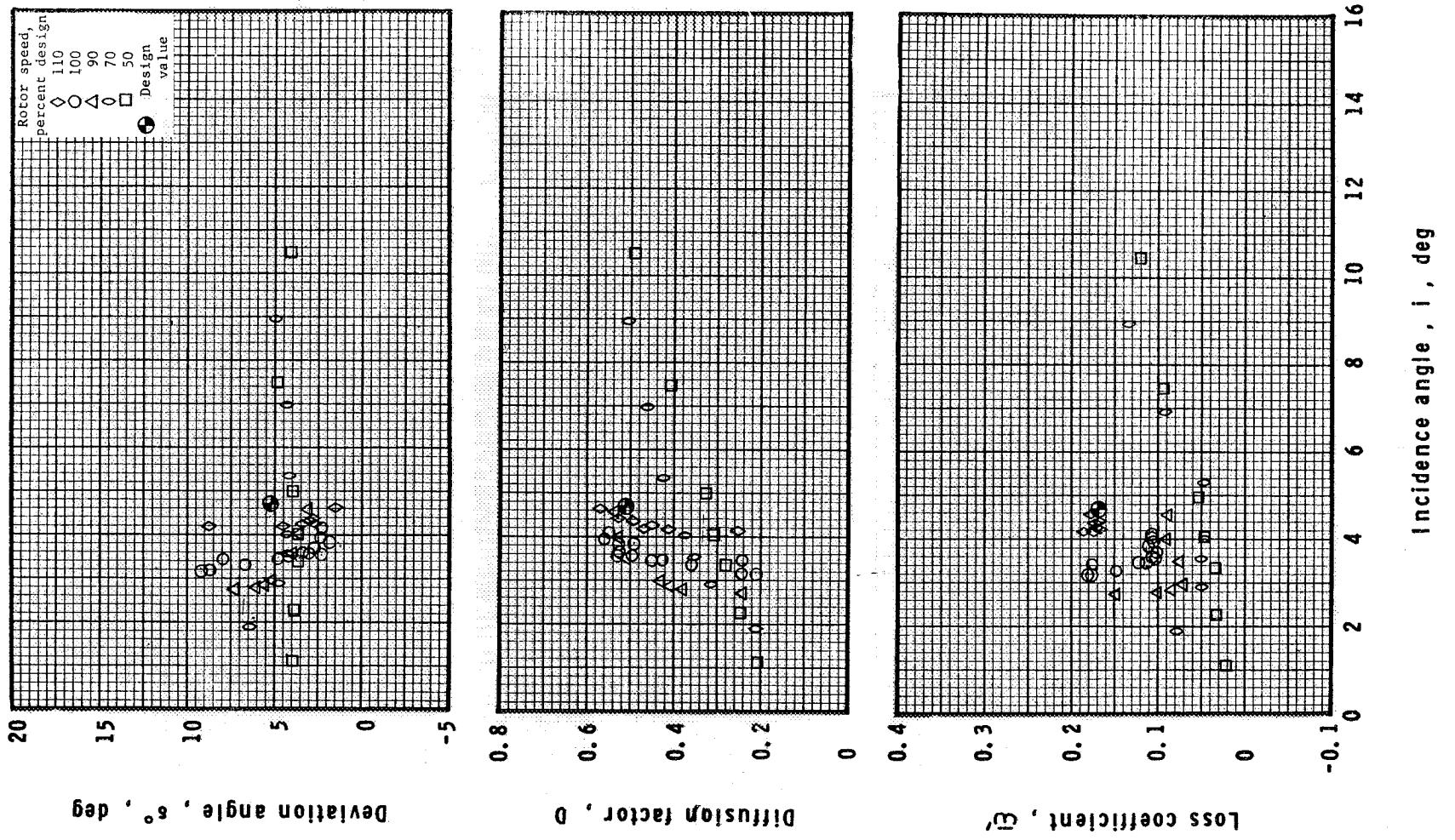


Figure 14(b). - Blade element data measured at 30% immersion from tip.

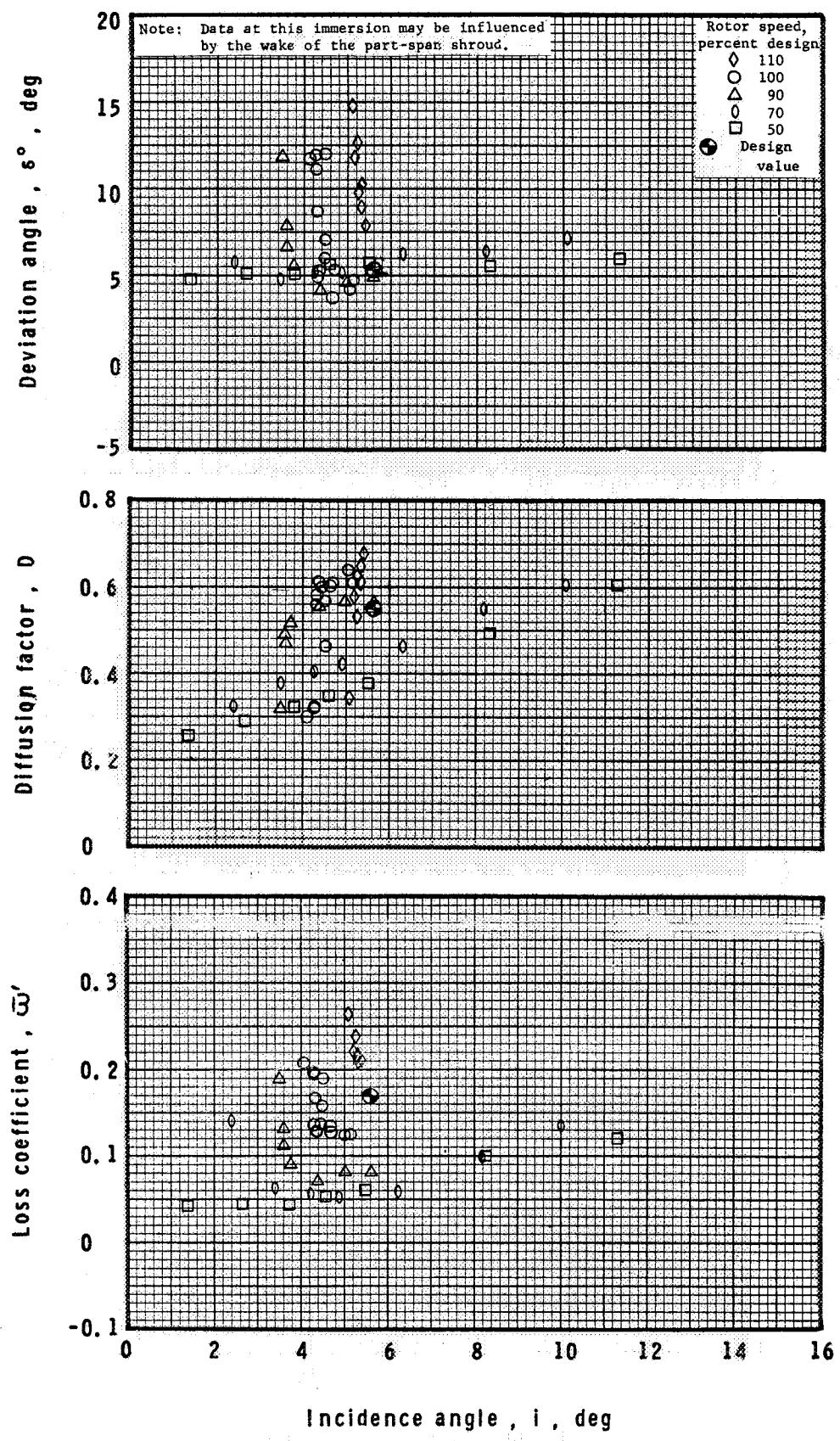


Figure 14(c). - Blade element data measured at 50% immersion from tip.

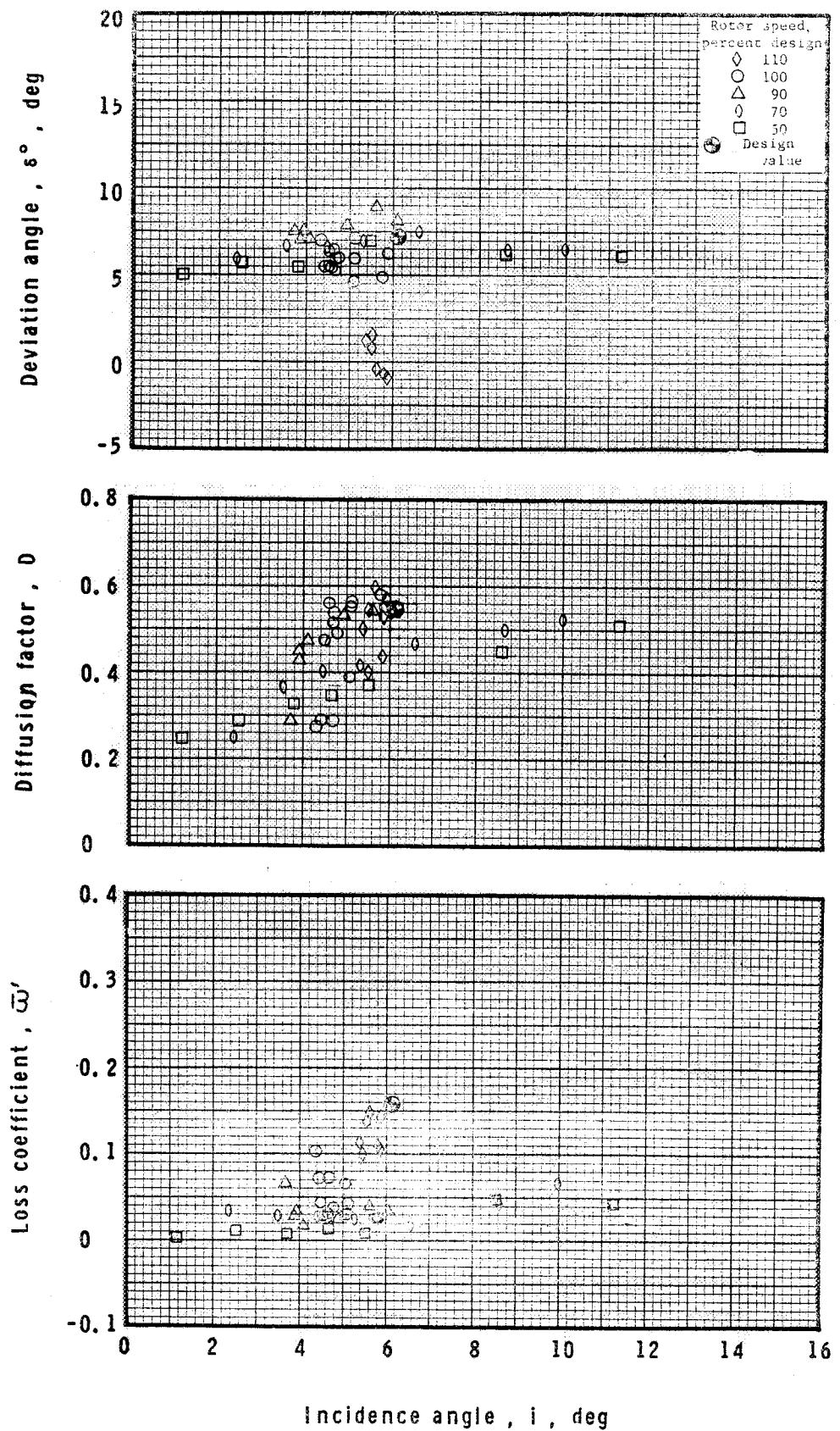


Figure 14(d). - Blade element data measured at 70% immersion from tip.

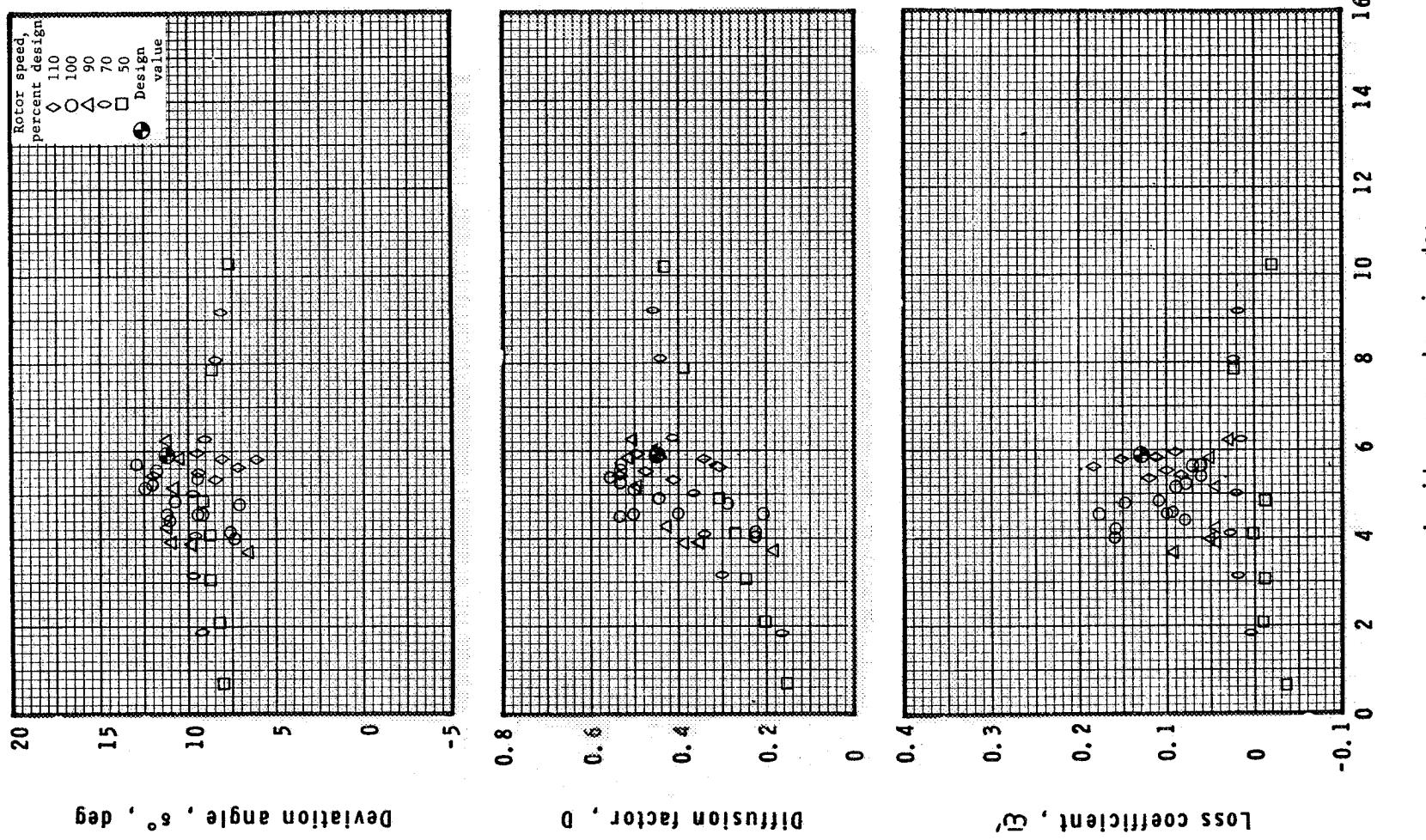


Figure 14(e). - Blade element data measured at 90% immersion from tip.

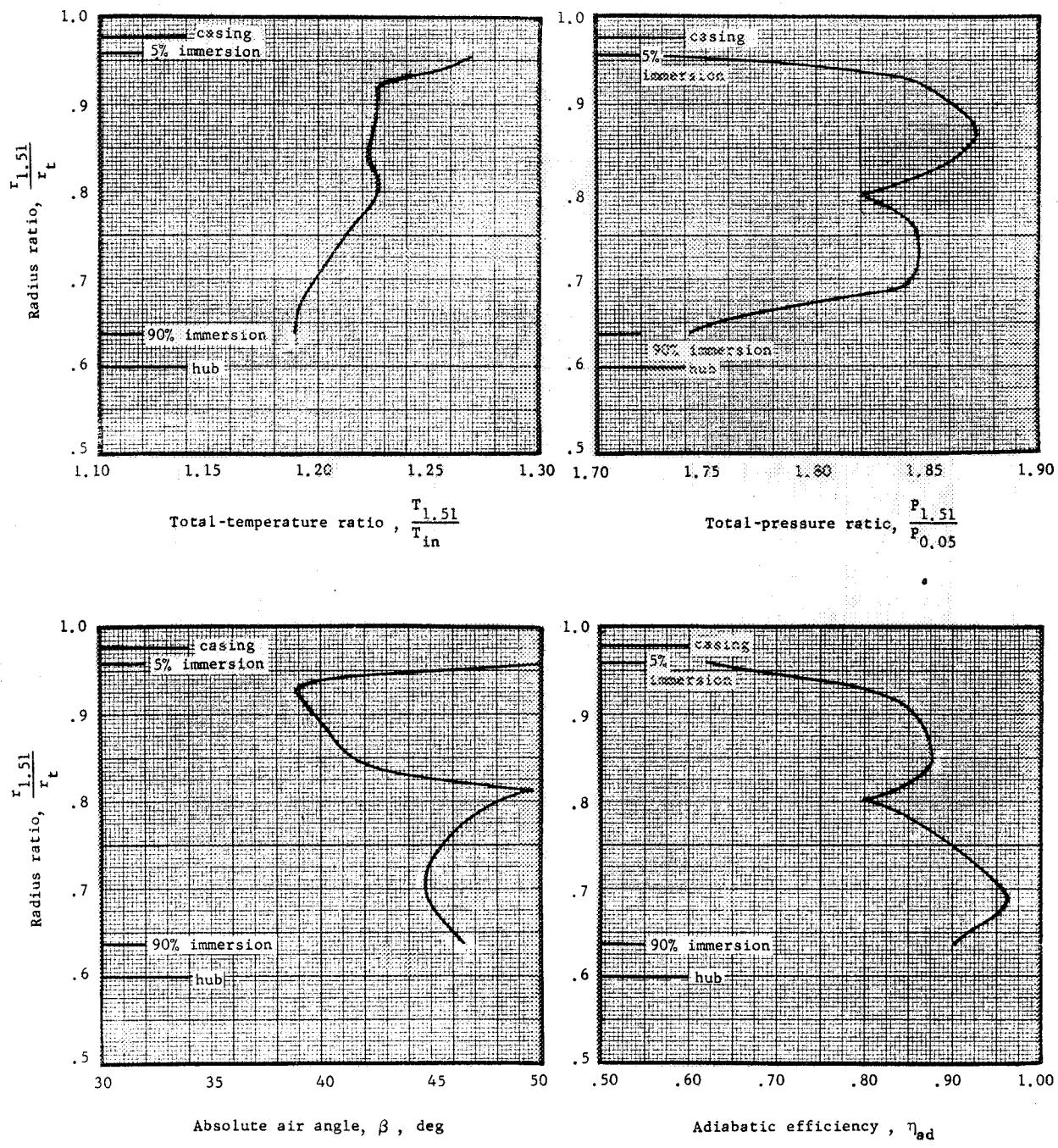


Figure 15. - Continuous traverse at rotor exit plane 1.51 for reading 124.

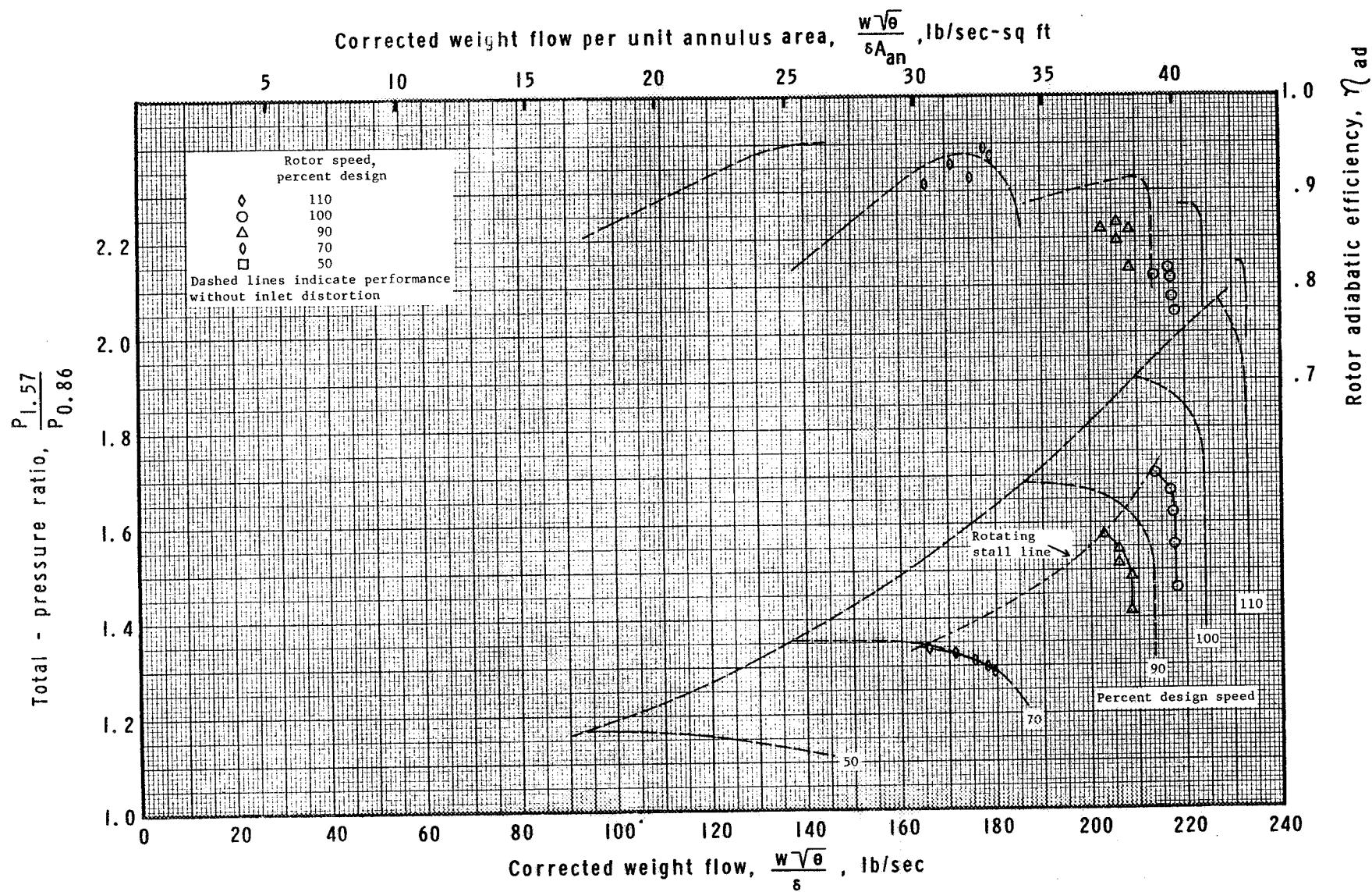


Figure 16(a). - Rotor performance map with radial distortion.

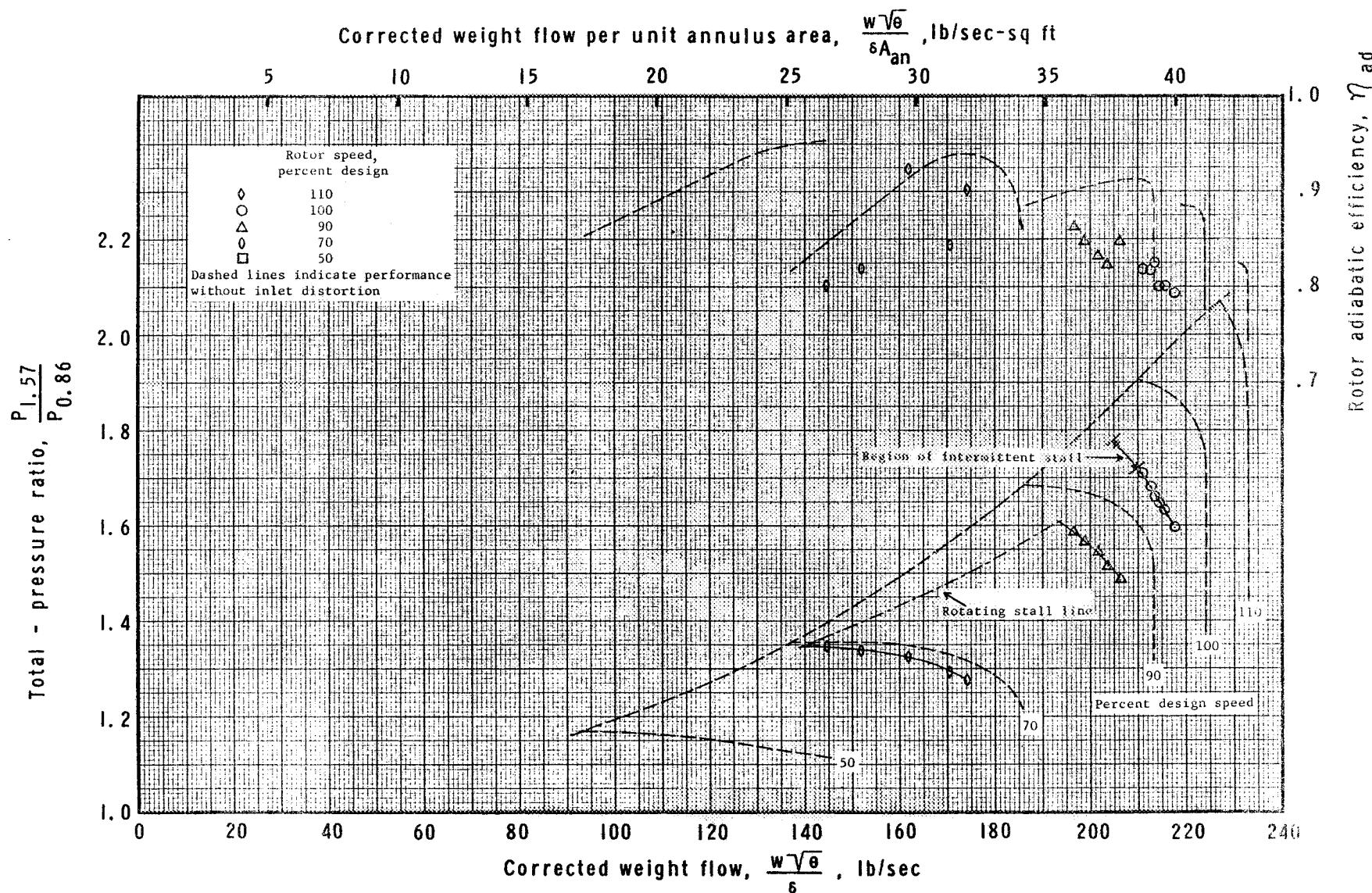


Figure I6(b). - Rotor performance map with circumferential distortion.

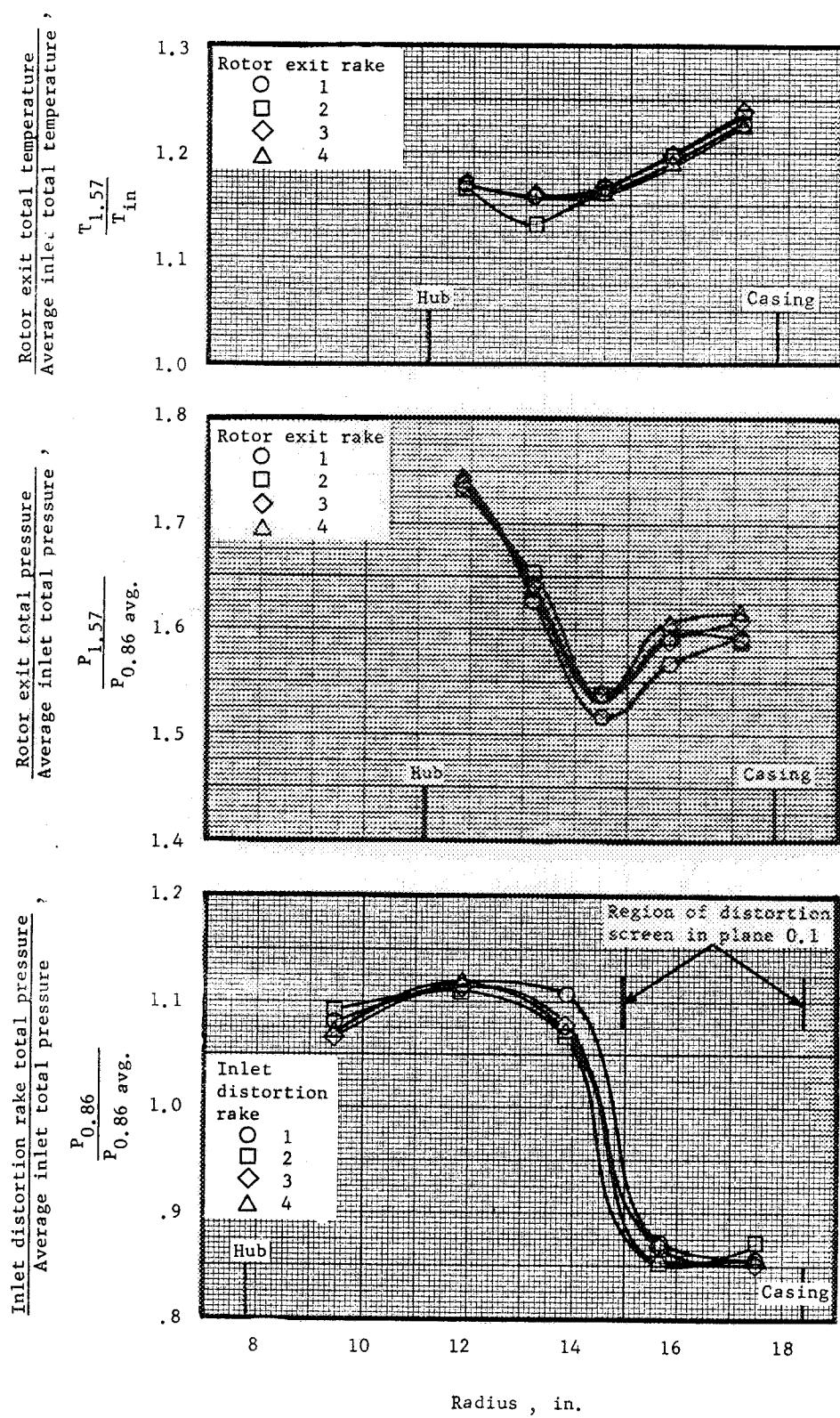


Figure 17(a). - Inlet total pressure, exit total pressure and exit total temperature profiles at 100% corrected speed with radial distortion, for reading 85.

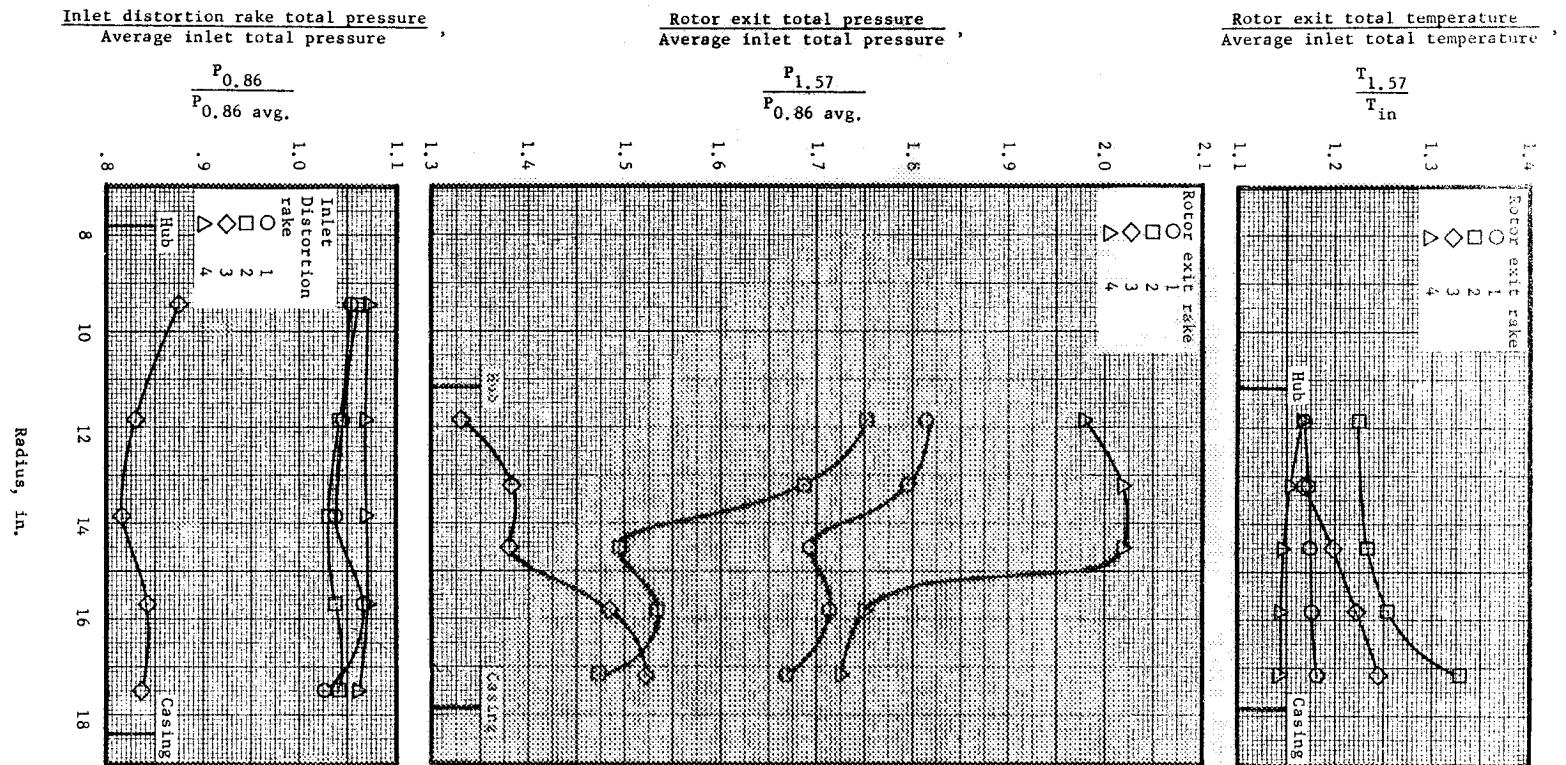


Figure 17(b). - Inlet total pressure, exit total pressure and exit total temperature profiles at 100% corrected speed, with circumferential distortion, for reading 101.

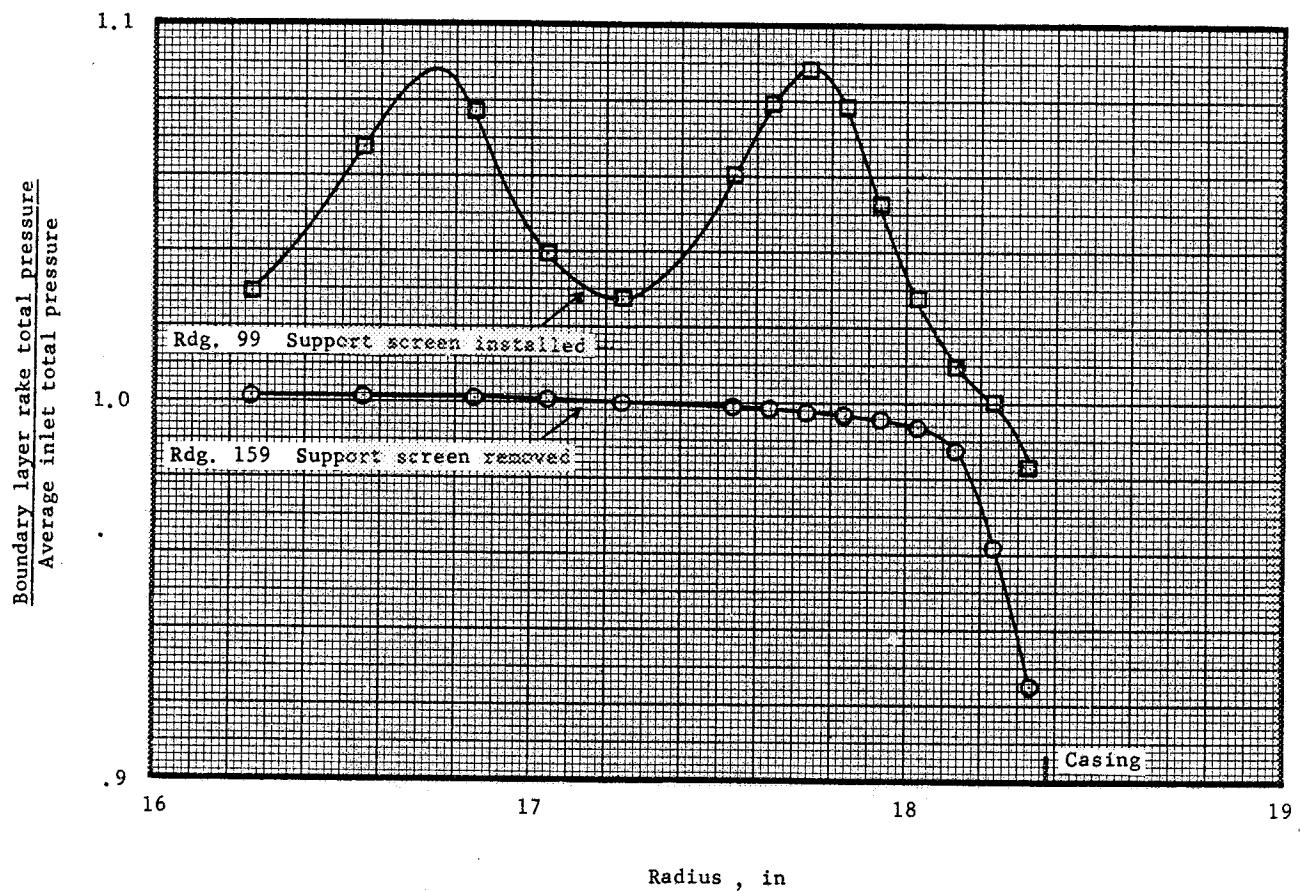


Figure 18. - Total pressures recorded by the boundary layer rake during undistorted inlet and circumferential distortion testing.